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ACTIVITIES OF THE UNITED NATIONS SYSTEM IN SCIENCE AND TECHNOLOGY FOR DEVELOPMENT

New developments and trends in the programmes and activities of the United Nations system in science and technology for development

Report of the Director-General for Development and International Economic Cooperation

SUMMARY

At the request of the General Assembly in its resolution 44/14 C, the report of the Director-General analyses developments and trends in science and technology since 1989 in three main areas: (a) endogenous capacity-building; (b) technology monitoring, assessment and forecasting; and (c) coordination and cooperation at the country level.

The report finds a consistent trend in the activities of the system towards greater emphasis on building sectoral capabilities for the management of technological change in the context of endogenous scientific and technological capacity at the national level. Technology monitoring, assessment and forecasting techniques are relatively new to developing countries and even to secretariats of organizations. Both are beginning to use them in long-range or strategic planning from the enterprise to the global level. The Centre for Science and Technology for Development and the United Nations Development Programme, through the United

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Nations Fund for Science and Technology for Development, have taken initiatives to enhance system-wide coordination of and cooperation in operational activities in science and technology at the country level, within the framework of General Assembly resolution 44/211.

The report recommends that the United Nations system should reinforce its in-house technology management and strategic planning capabilities and that the Centre and the Department of International Economic and Social Affairs should work closely in their respective system-wide focal point roles in technology assessment and early identification, analysis and forecasting of global economic developments.

Also, the possibility should be considered of organizing in 1992 a meeting of global scope on the role of technology monitoring, assessment and forecasting in strategic planning and management. The United Nations should find ways to strengthen its field representation in science and technology within the overall efforts being made by the system in this respect.

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I. BACKGROUND

1. In its resolution 34/218 of 19 December 1979, the General Assembly established the Intergovernmental Committee on Science and Technology for Development to assist it, inter alia, in the task of monitoring the activities and programmes related to science and technology within the organs, organizations and bodies of the United Nations system.

2. In pursuance of that mandate, the Secretary-General has provided the Intergovernmental Committee with regular reports on the activities of the United Nations system in science and technology for development. 1/ At its ninth session in 1987, the Secretary-General made available to the Intergovernmental Committee, at its request, a cross-organizational review of the medium-term plans of the organizations of the United Nations system and programme analysis in the area of science and technology for development (E/1987/51).

3. In its resolution 44/14 of 26 October 1989, following the 10-year review of the implementation of the Vienna Programme of Action on Science and Technology for Development, carried out by the Intergovernmental Committee, the General Assembly requested the Director-General for Development and International Economic Cooperation to ensure close monitoring and follow-up of the mandated programmes and activities of the United Nations system in the areas of science and technology for development for the successful implementation of the Vienna Programme of Action, and to report thereon regularly to the Committee.

II. METHODOLOGY

4. In response to that resolution, the present report seeks to provide an analytical overview of system-wide programmes and activities in science and technology. In view of the previous 10-year experience of the Intergovernmental Committee (as well as the Economic and Social Council, the Committee for Programme and Coordination and the General Assembly) in coordination, monitoring and review of the activities of the system in science and technology, including particularly the recent 10-year review of the Vienna Programme of Action, this report deals primarily with a focused identification and analysis of the main new trends which are emerging within programmes and activities in science and technology. Such trends may derive from the implementation of new intergovernmental mandates or appear in the substantive emphasis of regular programme activities within long-standing mandates. Likewise, new trends can be observed as a result of demands of Member States in the orientation and areas of emphasis of technical cooperation projects at the national, regional, interregional and global levels.

5. The report is therefore organized on the basis of the following main clusters of issues, where those trends are observed:

Endogenous capacity-building

Technology monitoring, assessment and forecasting

Coordination and cooperation at the country level

6. In June 1990, the Director-General requested the executive heads of the following 26 organs, organizations and bodies of the United Nations system to provide him with the necessary elements to assist him in the preparation of the report:

United Nations organizations and bodies

Department of International Economic and Social Affairs

Department of Technical Cooperation for Development

Economic Commission for Africa (ECA)

Economic Commission for Europe (ECE)

Economic Commission for Latin America and the Caribbean (ECLAC)

Economic and Social Commission for Asia and the Pacific (ESCAP)

Economic and Social Commission for Western Asia (ESCWA)

United Nations Centre for Human Settlements (Habitat)

United Nations Conference on Trade and Development (UNCTAD)

United Nations Centre on Transnational Corporations

United Nations Development Programme (UNDP)

United Nations Environment Programme (UNEP)

United Nations University (UNU)

United Nations specialized agencies and related organizations

Food and Agriculture Organization of the United Nations (FAO)

International Atomic Energy Agency (IAEA)

International Civil Aviation Organization (ICAO)

International Labour Organisation (ILO)

International Maritime Organization (IMO)

International Telecommunication Union (ITU)

United Nations Educational, Scientific and Cultural Organization (UNESCO)

United Nations Industrial Development Organization (UNIDO)

Universal Postal Union (UPU)

World Health Organization (WHO)

World Intellectual Property Organization (WIPO)

World Meteorological Organization (WMO)

World Bank

Replies were received from all of the above, as well as a contribution from the Outer Space Affairs Division of the Department of Political and Security Council Affairs.

7. In keeping with the selective approach chosen, the Director-General has included suggestions for programmes and activities of special significance which each organization might cover. As such, the contribution of each organization does not necessarily reflect the entire spectrum of its activities in science and technology. Reference should also be made to previous reports on the subject mentioned in paragraph 2.

8. The present report is based on those replies, as well as on the information contained in official documents on programmes and activities of the United Nations system including the reports of executive heads to their legislative organs and approved medium-term plans and programme budgets.

9. To the extent possible, a differentiation is made between regular programme activities and operational activities of the system, including among the latter those involving assistance to the least developed countries.

10. In the final section of the report, the Director-General brings to the attention of the Committee his conclusions on the present situation and outlook of the programmes and activities of the system in science and technology and proposes measures aimed at improving system-wide coordination and cooperation in the areas covered.

Table 1. Contributions from the United Nations system

Entity	Activities initially suggested
	A. United Nations organizations and bodies
United Nations Centre on Transnational Corporations	Developments in negotiations on the code of conduct on transnational corporations
	Research on the environmental effects of transnational corporations
	Research on the effects of new technologies and their implications for developing countries
	New technical assistance projects in Africa dealing with technology transfer
Department of International Economic and Social Affairs	Follow-up to the report of the Secretary-General to the Economic and Social Council at its second regular session of 1990 on the role of the United Nations in the early identification, analysis and monitoring of world economic developments (E/1990/80 and Corr.1, annex)
	Follow-up to "Overall socio-economic perspective of the world economy to the year 2000" (1990); chapter on new technologies

Entity	Activities initially suggested
	Environment and development issues
Department of Technical Cooperation for Development	Science and technology aspects of integrated development planning and implementation
	Progress in the study of environmental considerations taken into account in energy planning and energy resource development
	New trends in operational activities dealing with resource assessment, energy planning and technology transfer
Department of Political and Security Council Affairs (Outer Space Affairs Division)	Monitoring, assessment and forecasting of potentials of space technology and its practical applications
	Implementation of the recommendations of the Second United Nations Conference on the Exploration and Peaceful Uses of Outer Space
United Nations Centre for Human Settlements	New activities on the development of national technological capacity for production of selected building materials
	Research activities on technology in human settlements: the role of construction
	Operational activities
UNCTAD	Programme for developing regions on technology policy challenges and options (USSR contribution)
	Science and technology for the least developed countries: outcome of the Paris Conference
UNDP	Recent trends in global and interregional projects involving research and development
	Perspectives on UNDP assistance to the least developed countries in the area of science and technology for development
UNEP	New projects aimed at strengthening countries' capacities to integrate environmental considerations into national energy policy, planning and development
	Assistance for the development of industrial environmental policies
	Assistance for the improvement of scientific and institutional capabilities for assessment and control of chemical hazards

Entity	Activities initially suggested
UNU	Technology monitoring, assessment and forecasting within the global alert role of UNU, including the activities of the Institute for New Technologies (INTECH) and the World Institute for Development Economics Research (WIDER) in that area
	Studies on the role of African institutions of higher education in the definition of science and technology policies in the region
	Contribution to the development of scientific and technological education and research in African universities in the 1990s
	Technology monitoring, assessment and forecasting in future programmes
ECA	Outcome of the meeting of the Intergovernmental Committee of Experts on Science and Technology for Development (1990)
	Technology monitoring, assessment and forecasting in the region
ECE	Outcome of the session of the Senior Advisers to ECE Governments on Science and Technology (1990)
	Outcome of the seminar on forecasting in the formulation of science and technology policies
ECLAC	Outcome of the twenty-third session of ECLAC: technology in the proposed regional development strategy
	Meeting on industrial development strategy in Central America: technology policy
	Technology monitoring, assessment and forecasting in the region
ESCAP	Outcome of the regional meeting of Ministers of Industry and Technology (1990)
	Promotion of the assessment of new technologies and research in biotechnology and micro-electronics
ESCWA	Progress on the study of recent technological advances and their implications for the economic development of ESCWA countries
	Technology monitoring, assessment and forecasting in the region

Entity	Activities initially suggested
	B. Specialized agencies and related organizations
FAO	Follow-up to the 1984 joint FAO/UNDP thematic evaluation of projects in national agricultural research
	Experience with the Research and Technology Development Division in terms of endogenous capacity-building
IAEA	Activities on the monitoring, assessment and forecasting of nuclear technologies and their effects on development
	Training of physicists, chemists and engineers
	New developments in cooperation with the Trieste Centre
	New capacity-building projects within current operational activities
ICAO	Monitoring, assessment and forecasting of new aeronautical and aircraft technologies
	New assistance projects dealing with technological aspects of the planning of air transport
ILO	Progress on the ways of anticipating the employment implications of technological change, including the productivity-enhancing effects of new technologies
	Assessment of the potential effects of new technologies on working conditions and working environments
IMO	Joint programmes with UNIDO for the development of shipbuilding and marine engineering as well as safety rules for transport, cargo and fishing vessels
ITU	Monitoring, assessment and forecasting of telecommunication technology
	New projects dealing with research and development in applied telecommunication technology
	Cooperation with UPU in electronic mail technology
UNESCO	International Scientific Council for Science and Technology Policy Development (second session, 1991)
	Assistance to least developed countries in science and technology policy
	Recent trends in university education in basic sciences and engineering in Africa

Entity	Activities initially suggested
	UNESCO/UNEP cooperation in environmental education in universities and institutes of technology
	International research project on new concepts applicable to science and technology policy analysis and formulation
UNIDO	Technology management networks in developing countries: International Centre for Science and High Technology (with the financial cooperation of the Government of Italy)
	International Centre for Evaluation and Application of Materials (in cooperation with the Government of Brazil)
	International Centre for Genetic Engineering and Biotechnology: ICGEB (Perspectives 1990-1994)
	Cooperation between EUREKA and developing countries
UPU	Monitoring, assessment and forecasting of new technologies, including electronic mail and postal computerization
	New trends in technology-based operational activities
World Bank	Outlook for new research activities on technology change and diffusion, the relationship between technology and human resources and the effects on the development process
	New loan projects involving support to industrial technology modernization and indigenous technology development
WHO	Technology monitoring, assessment and forecasting activities related to new health care and pharmaceutical technologies; cooperation with the International Society of Technology Assessment in Health Care (ISTHAC)
	Outlook for global research and development programmes in health and biomedicine
WIPO	Developments in negotiations on the revision of the Paris Convention
	New projects on technology information systems using patent data
WMO	Monitoring, assessment and forecasting of new scientific and technological developments having implications for global meteorological activities
	Cooperation with ITU in telecommunication facilities
	New trends in technical cooperation activities

III. ENDOGENOUS CAPACITY-BUILDING

A. Introduction

11. The Vienna Programme of Action, adopted in 1979, the validity of which was reaffirmed in 1989 by the General Assembly at its forty-fourth session, contains a comprehensive identification of the substantive issues that developing countries will continue to face in their scientific and technological development. The paramount goal of the Vienna Programme of Action is the strengthening of the developing countries' own endogenous scientific and technological capacities. In 1989 the Advisory Committee on Science and Technology for Development suggested a definition of endogenous capacity in the following terms:

> "An 'endogenous capacity' may be defined as the extent of local capability to exercise independent, informed judgement and actions regarding the generation, acquisition, and deployment of technologies for economic and social development, including the fulfilment of basic human needs, within a society. Ideally, such capacity will have the ability to self-regenerate, while maintaining good linkages around the world as one way of constantly tapping global activities in science and technology" (A/CN.11/91, para. 13).

12. The basic objective of building the endogenous science and technology capacities of developing countries will primarily require the efforts of the countries themselves in partnership with the international development cooperation community.

13. That endogenous capacity objective was further stressed by the General Assembly when it adopted at its eighteenth special session the Declaration on International Economic Cooperation, in particular the Revitalization of Economic Growth and Development of the Developing Countries 2/ and, at its forty-fifth session, the International Development Strategy for the Fourth United Nations Development Decade. 3/ Both the Declaration and the Strategy call on the international community to support the efforts of developing countries - especially the least developed countries - to acquire the capabilities to participate in the progress made possible by advances in science and technology.

14. The Second United Nations Conference on the Least Developed Countries, organized by UNCTAD, was held in Paris from 3 to 14 September 1990. In adopting the Paris Declaration and the Programme of Action for the Least Developed Countries for the 1990s, the Conference emphasized the need for strengthening the scientific and technological base as a necessary condition for the medium and long-term transformation of the least developed countries. The Programme of Action recommended that those countries should seek to enhance their endogenous capacity to deal with the development and application of science and technology, particularly by strengthening their national scientific and technological infrastructures, introducing scientific and technological education, improving the quality and quantity of manpower training, linking production with indigenous efforts and devising appropriate mechanisms for the orientation of programmes and the practical application of the results of scientific research. 4/ In resolution 45/206 of 21 December 1990, the General Assembly endorsed the Paris Declaration and

the Programme of Action and requested the Secretary-General to report, on a continuing basis, on the implementation of the Programme's provisions.

15. On 21 December 1990, the General Assembly adopted resolution 45/195 in which it welcomed the publication of The Challenge to the South: The Report of the South Commission. 5/ That report contains important ideas on the role of science and technology in the development process and on self-reliant and people-centred strategies for science and technology.

16. During the second regular session of the Economic and Social Council in 1991, a meeting will be convened for an informal exchange of views on the conclusions and recommendations of the South Commission report.

B. United Nations system activities

17. Within the framework of actions by the United Nations system, the particular involvement of ILO, FAO, UNESCO and WHO in activities of endogenous capacity-building in science and technology provides an important core of support for the efforts, including operations, to assist developing countries. This is especially true in the case of the least developed countries, in whose economies the applications of science to agriculture, health and education have high priority.

World Health Organization (WHO)

18. Within the framework of its strategy for "health for all by the year 2000", WHO has been increasingly concerned with the need to strengthen the scientific and technological capabilities in developing countries and has consequently made major efforts to build research institutions - including career structures - and create effective health research systems. Training in research methodology and in research management is receiving increasing emphasis through formal courses, workshops and practical experience.

19. An important development in this connection took place on 17 May 1990 when the World Health Assembly, at its forty-third session, adopted resolution WHA43.19 on the role of health research. That resolution stressed the vital role of scientific and technological research in achieving health objectives and the fact that many developing countries lack the scientific and institutional capability to address their particular problems. It calls for research to identify and understand the countries' own priority health problems, foster innovation and experimentation and contribute to new knowledge.

20. In particular, the resolution urges developing countries to build and strengthen national research capabilities by investing resources in national institutions, by providing appropriate career opportunities to attract and retain the involvement of their own scientists, and by creating environments that will foster scholarship and creativity.

21. It also requests the Director-General to develop further a clearly enunciated health research strategy for WHO in order to translate the research goals, priorities and programmes into coherent and coordinated action in support of health for all; to promote the harmonization of science and research policies in health between WHO, the United Nations system and other international agencies and organizations; to develop more effective institutional arrangements for strengthening the research capabilities of member States, with special emphasis on disciplines of critical relevance to public health; and to explore the possibility of making specific provision within the total resources of WHO to support the strengthening of health-related research capabilities in member States.

22. WHO is also concerned with the establishment, organization and operational management of health system infrastructures through the application of rigorous managerial processes and related health systems research. Such activities deal also with the delivery of well-defined country-wide health programmes and with the absorption and utilization of appropriate technologies that form part of those programmes.

23. The following are examples of new operational projects of WHO which reflect the above-mentioned trends in science and technology capacity-building.

Haiti. Training for malaria prevention: 1990-1994 (UNDP $1 million)

Myanmar. Development of production of Hepatitis B vaccine in a pilot scale: 1988-1992 (UNDP $619,000)

Sudan. Strengthening of the capacity of the Ministry of Health in emergency preparedness and response: 1990-1992 (UNDP $418,000)

Yugoslavia. Development of a system for testing the quality and safety of food and water: 1990-1991 (UNDP $120,000)

Central America. Development of the management capabilities of national health services: 1990-1992 (UNDP $390,000)

Food and Agriculture Organization of the United Nations (FAO)

24. The General Assembly, in resolution 45/207 of 21 December 1990 on food and agricultural problems (including fisheries, marine products, forestry and primary forestry products), stressed the importance of science and technology in the development of agriculture, in the increase of food production and in the modernization of agriculture and, in that context, called on the international community to support scientific and technological training and research in developing countries in order to promote sustainable agricultural development in those countries. The resolution emphasized the urgency of strengthening international cooperation in the field of transfer of environmentally sound agricultural technologies and of facilitating the free exchange of information on experience and technology relating to food production, processing and storage, taking into account the need for developing countries to have assured access to advances in such fields as biotechnology and genetic engineering, at appropriate cost.

25. The long-standing approach of FAO to science and technology capacity-building is equally comprehensive. As stated in its programme of work and budget for 1990-1991, future increases in food and agricultural production will depend, in large measure, on continuous advances in agricultural knowledge and technologies as components of sustainable production systems. This will require effective research capacity to generate and adapt such technologies and ensure their proper application. Although progress has been made in many developing countries, national policies and capabilities in research still require strengthening. The transfer of technology needs to be actively pursued as developing countries will increasingly make use of advanced methodologies and techniques developed elsewhere when they are applicable to local conditions.

26. One of the most important objectives in research and technology development is the strengthening of national research capacity in developing countries. Particular attention will be paid to policy for and planning of agricultural research; enhancing national capabilities in the organization and management of research systems and programmes; and increasing developing countries' capacities for evaluation, adaptation and adoption of traditional and emerging technologies to meet the needs of farmers. Research and technology should be oriented towards sustainable agricultural development.

27. This capacity-building commitment in food and agricultural science and technology gives high priority to human resources development and particularly to education and training of qualified personnel. An expert consultation on strategy options for higher agricultural education will be held at Rome in mid-1991 to examine global case-studies and identify workable alternatives for programme development, institutional management and inter-institutional collaboration at national and regional levels. Moreover, a related expert consultation on the role that universities can play in the development of national agricultural research systems will be held at Rome in March 1991. The project on advanced centres of postgraduate agricultural education and research in India, is one of the largest projects funded by UNDP and executed by FAO and is a valid example of successful institution building. In conjunction with earlier programmes, the project helped to establish 28 national centres for postgraduate agricultural education and research, notably in post-harvest technology, agroforestry, veterinary medicine, immunology, energy management, aquaculture, horticulture, and plant and animal biotechnology.

United Nations Educational, Scientific and Cultural Organization (UNESCO)

28. Notwithstanding the recent structural reorganization of its programme, the vast contribution of UNESCO to system-wide endogenous capacity-building in science and technology is inherently transdisciplinary and, although centralized in the major programme area on Science for Progress and the Environment, is not limited to it. In a total view of the organization's contribution, one should also take into account the major programme areas on Education and the Future and on Social and Human Sciences in a Changing World, the major programme area on the UNESCO Contribution to Prospective Studies and to Strategies Concerned with Development, as well as the transverse programmes - General Information Programme and Future-Oriented Studies.

29. A number of significant new trends stemming from the approved programme and budget for the biennium 1990-1991 and the Director-General's preliminary proposals concerning the draft programme and budget for 1992-1993 could be analysed as follows: the major lines of emphasis of the major programme area II (Science for Progress and the Environment) lie in the training, planning, management and exchange of information in basic engineering and environmental sciences. Emphasis is placed on the role of networks in cooperation between higher education and research institutions as well as improvement and expansion of university education. Top priority is attached to environmental education for teachers, decision makers and the general public. In the programme on Science, Technology and Society, emphasis is placed on the raising of public awareness and the dissemination of scientific knowledge to the public at large.

30. Assistance in the formulation of science policy has involved mainly the least developed countries in Africa. Also, a new emphasis is being given to the almost unique activities of UNESCO regarding the ethical implications of science and technology, which seek to develop awareness of the current and future significance of science ethics among researchers, decision makers and the public.

31. In 1990, the Scientific Coordinating Committee for the UNESCO programme on the human genome was created. That Committee consists of representatives from intergovernmental and non-governmental organizations and eminent scientists from developed and developing countries. The Committee is to advise UNESCO on the planning and implementation of this programme and to promote an exchange of information between organizations involved. The first meeting of the Committee was held in Paris on 1 February 1990.

32. UNESCO has now stepped up its involvement in international cooperation in the human genome, a major undertaking aimed at discerning the genetic constitution of man. The development of that cooperation is of interest to the United Nations system, particularly WHO. One example of this involvement is a Symposium on Human Genome Research: Strategies and Priorities, which was held at UNESCO House from 29 to 31 January 1990. The Symposium was attended by some 250 scientists, among them seven Nobel laureates, and leaders of national human genome projects. The Symposium focused on one issue - the human genome - and covered not only every angle of this subject but also encompassed all those areas which have a direct or indirect influence on the human genome.

33. As an executing agency for UNDP-funded operational activities, UNESCO is currently involved in the execution of a number of innovative capacity-building projects in developing countries, examples of which are given below.

Burundi. Development of the Faculty of Applied Sciences of the University of Burundi: 1988-1992 (UNDP $2.5 million).

Nepal. Development of the country's science and technology information network: 1989-1992 (UNDP $460,000).

Yemen. Technical support to the Marine Sciences Resources and Research Centre: 1990-1991 (UNDP $516,000).

Regional. Development of an African network of scientific and technological institutions: 1990-1991 (UNDP $763,000).

Development of a Latin American network of biotechnology centres: 1990-1991 (UNDP $791,000).

International Labour Organisation (ILO)

34. The endogenous capacity-building activities of the ILO in science and technology have addressed the interrelated issues of management and vocational training, technology - including labour-intensive applications - and employment.

35. The programme on management development is aimed at enhancing the contribution of management to economic and social development in member States, particularly in developing countries, where the shortage of indigenous managerial and supervisory skills and low productivity pose serious problems. More specifically, the programme aims to assist member States to define and implement an effective approach to entrepreneurship, small enterprise and management development; to strengthen relevant national, regional and interregional programmes and institutions; and to promote improved management practices and increased productivity in sectors commanding priority in the development strategies of member States.

36. The Vocational Training Programme aims at increasing the efficiency of national training systems and the availability of skilled manpower in priority sectors in urban or rural settings. It provides assistance to national centres, develops training material and provides guidance to instructors. The programme pays particular attention to disadvantaged groups such as women, unemployed rural youth and refugees.

37. A project in Benin provided training for public and private sector trainers at the Vocational Centre for Enterprise Development. The establishment of a production unit improved the quality of training and knowledge of the local market and reduced the Centre's dependency on government financing. In Mozambique, the second phase of a project was completed for the development of the Machava Training Centre and the training scheme of the Ministry of Construction and Water, which included training in building, construction, carpentry, mechanics, welding, electricity and accountancy. In Nepal, two vocational training centres were established and a vocational training programme was developed in basic skills for industrial employment as well as for self-employment. Another project developed the capacity of countries of the Pacific area to operate job-oriented technical training schemes and trade testing in construction, electricity and mechanics, in both urban and rural areas. A project in Turkey provided training in management, foreign languages and computers and produced learning materials and audio-visual aids; a proposal was also put forward for the establishment of a national industrial training system.

38. An important subregional skills development project was launched by the ILO for eight Arab countries, to enhance national vocational training systems and their response to changing manpower needs in the public and private urban and rural

sectors. In India, work began on the establishment of a computerized numerical control machine tool centre at the advanced training institutes of Bombay and Kampur; the project will support the implementation of the Ministry of Labour's long-term programme to modernize and restructure the country's vocational training system. A new project in Nicaragua to strengthen the capability of the national training system will focus on the improvement of management, the extension of existing equipment, the training of staff and the design of training programmes and training material. Another project established workshops in various islands of the Maldives to train young people in diesel mechanics, jewelry, boat building and carpentry, so that they can find employment with local enterprises.

39. The programme on technology, employment and development is aimed at strengthening the capacity of Governments and employers' and workers' organizations to carry out policies enabling them to benefit fully from new technologies while minimizing any negative employment effects which might be associated with them.

40. Sectoral studies were prepared on the technological behaviour of public enterprises in developing countries, the contribution of the banking sector to technological development, and the technological capability of the construction industry in the Arab States. Further research was carried out on ways of creating technological capability in developing countries, and on national technology policies.

41. The activities of the ILO in respect of biotechnology continued with the completion of several country case-studies, together with an overview of the implications of biotechnology for the international division of labour; the conclusions arising from this work were published in an article in the International Labour Review; and 13 reports and publications on the implications of micro-electronic technology and biotechnology were completed for both industrialized and developing countries. A technical cooperation project on the dissemination of improved technologies for rural women in Ghana was concluded and a follow-up project funded by UNDP was launched. Extrabudgetary financing was obtained for a project on technologies for rural employment in Bangladesh, with special reference to women.

42. The Information Service on Technological Alternatives for Development (INSTEAD) pursued its data collection, cataloguing and abstracting for the INSTEAD database. Requests continued to be received at a steady rate and collaboration with other appropriate technology institutions was strengthened.

43. The ILO contributed actively to preparations for the end-of-decade review of the Vienna Programme of Action on Science and Technology for Development. In the course of an inter-agency mission to Nepal, advisory services were provided on the assessment of the effect of activities in this area on the country's ability to build up its technological capability.

44. Other activities served to promote the role of non-governmental organizations in the development of new technologies in rural areas by strengthening their capacities to respond to the needs of small-scale producers. In the field of appropriate technologies for handicrafts and rural industries, advisory services

and project formulation missions were carried out in eight developing countries, and technical cooperation projects continued in some 20 other countries.

45. The programme on infrastructural and rural works and employment is designed to assist member States in implementing labour-intensive work schemes as a means of employment promotion and long-term income generation: 26 labour-intensive work programmes were in progress in 22 countries, special attention being paid to the effect of structural adjustment policies on the division of tasks between the public sector and local constructors and institutions.

46. Technical advisory services for the design of new programmes were increasingly oriented towards the needs of areas affected by environmental degradation, natural disasters and civil strife. Technical surveys, preparatory studies and other advisory or programme formulation missions were carried out in 11 countries, mainly in sub-Saharan Africa. Seminars on appropriate policies and the design of labour-based work programmes were held in three Central American countries and for the sub-Saharan subregion; these seminars took account of the need to create a technical and managerial capability among local communities.

47. ILO services in connection with labour-based road construction, rehabilitation and maintenance continued to focus on the provision of technical advice, training input and the dissemination of training materials. Operational projects were under way in 12 countries in Africa and Asia, many of them related to parallel investment projects financed by development banks and bilateral agencies. In projects in Ghana and Madagascar, special emphasis was placed on the training of small-scale contractors. In Mozambique and Uganda, the main focus is the rehabilitation of essential feeder roads destroyed by civil strife. To achieve a better understanding of the scope and potential of labour-based methods, efforts were made to influence the educational curricula of civil engineers. In particular, the ILO helped the University of Nairobi to arrange a workshop for the heads of faculty of several engineering colleges on the integration of labour-based methods into existing curricula.

United Nations Industrial Development Organization (UNIDO)

48. Technology-based industrialization is at the centre of the development strategies of developing countries. In 1990, the Economic and Social Council adopted a provisional multi-year work programme for its in-depth consideration of major policy themes during the period 1992-1994, which includes the discussion of technology and industrialization in the development process, following the themes of the international trade system and environment and development.

49. On 21 December 1990, the General Assembly adopted resolution 45/196 on industrial development cooperation and the diversification and modernization of productive activities in developing countries. This resolution, which constitutes an important statement in terms of the emphasis it places on capacity-building, recognizes that the efforts of developing countries to develop their industrial and technological capabilities should be supported by the international community and that the transfer of technology to developing countries is essential. The resolution stresses the role of UNIDO in assisting developing countries in the

formulation of scientific and technological programmes and plans for industrialization in their countries, and welcomes the special trust fund schemes launched by UNIDO to develop alternatives to traditional assistance programmes.

50. On education and training of specialized personnel, the resolution requests the Secretary-General to report to the General Assembly, at its forty-sixth session, on ways and means of promoting the enhancement of United Nations activities with regard to the training of scientists, engineers and entrepreneurs in developing countries, with a view to promoting all related sectors and disciplines supporting industrial development, modernization and diversification of productive activities.

51. The medium-term plan of UNIDO for the period 1992-1997 identifies the transfer of technology as one of the five priority areas under which innovative thematic programmes are contemplated, and a unified strategy for technology has been developed by the organization.

52. As envisaged in the medium-term plan, the thematic emphasis lies on the integration of industrial and technological development, for which several types of cooperation are necessary. These are (a) research and studies on technology, focused on three main areas: (i) the effect of new technologies on socio-economic development; (ii) the trends, options and cooperation potential in specific industrial sectors; and (iii) cross-sectoral policies and learning strategies for technological development; (b) technical cooperation in creating and strengthening basic technical infrastructure for industrial development with particular regard to repair and maintenance, quality assurance and control, product and process engineering, research and development, and related extension services within a clearly structured national policy framework, including measures specifically designed for the development of small- and medium-scale industry; (c) promotional activities, consisting of ad hoc advisory services, awareness workshops and project development activities for technological cooperation at national, regional and interregional levels, as well as in the context of enterprise-to-enterprise cooperation; (d) advisory services through the Technological Information Exchange System on technology negotiation and acquisition, supplemented by intensified dialogue between technology suppliers and recipients and periodic studies on international technology markets; and (e) technological information services, primarily through the Industrial and Technological Information Bank network.

53. The substantial and long-standing technical cooperation activities of UNIDO in the area of endogenous technology capacity-building have developed further (see also paras. 142-147).

54. The transfer of technology is an integral part of most of the technical cooperation projects undertaken by UNIDO for the developing countries. Significant emphasis is given in them to human resource and entrepreneurial development, including pre-investment studies in a variety of areas ranging from simple industrial projects to the development of advanced modern technology products and intermediates. Assistance provided to industrial service institutions and technology development centres deals mainly with the practical application of basic research into pilot and demonstration activities and subsequent commercialization

and market acceptance. Specific examples are the strengthening of the Institute of Materia Medica and the Centre national de recherche scientifique in Viet Nam, the Centre national de recherche pharmacéutique in Madagascar and the Medicinal Plants Research Centre in Turkey, where a factory has been renovated which now produces laurel leaf oil, the essential oil of Laurus nobilis. A biotechnology centre was initiated at the Institut national de la recherche scientifique in Tunisia with facilities and personnel to handle local problems, and the UNIDO Regional Programme for Biotechnology for Latin America has been established to enhance the capacities of national institutions, including facilities for production on a small scale of human and veterinary vaccines, for example.

55. Despite the fact that technologies for the production of carbon fibres and their composites are highly sophisticated, successful projects were developed for Brazil, China, India, the Republic of Korea and Romania. Food development centres have been established in China and Egypt and are in the process of being established in Sri Lanka and Viet Nam. Further projects include: a sponge iron pilot plant in India; a pilot production of wettable powder formulation in Cuba; the development of environment-friendly pesticides in Hungary and in China; and the latest available technologies in the field of toxicological evaluation of pesticides in the Republic of Korea. The development of the necessary technologies for small-scale lime production has progressed satisfactorily during the past two years in Botswana, the Gambia and Togo.

56. At the enterprise-to-enterprise cooperation level, successful technical assistance projects in the North-South and South-South contexts, funded by such countries as Belgium, France and Italy, are under way in several developing countries in Africa, Asia and Latin America. A large number of specific cooperation agreements were reached between small- and medium-scale industries of developed and developing countries on different aspects of technology transfer, joint ventures and training. Similarly, within the South-South cooperation context, several agreements have taken place between Indian small and medium enterprises and those from Egypt, Malawi and the Philippines.

57. Different specific technologies have been adapted and promoted (including new ones) by UNIDO through its technical cooperation projects in the chemical, metallurgical, agro-industrial and engineering industry sectors.

World Intellectual Property Organization (WIPO)

58. The development cooperation activity of WIPO consists mainly of assistance to developing countries in the establishment or modernization of intellectual property systems suited to their development goals in the following ways:

(a) Developing human resources;

(b) Facilitating the creation or improvement of national or regional legislation and its enforcement;

(c) Facilitating the creation or improvement of governmental and other institutions for the administration and effective implementation of national or regional legislation;

(d) Encouraging adherence to WIPO administered treaties;

(e) Encouraging domestic inventive and creative artistic activity, and the exploitation of its results;

(f) Developing the teaching of intellectual property law;

(g) Developing the profession of intellectual property lawyer and agent;

(h) Facilitating the acquisition of foreign, locally protected technology through licensing contracts, and the access to foreign works protected by copyright;

(i) Facilitating the access to and the use of technological information contained in patent documents;

(j) Facilitating participation in certain WIPO meetings.

59. The training has taken various forms such as study attachments overseas and on-the-job supervision by international and national experts, and also in the form of courses, study visits and seminars. The training has provided basic knowledge of industrial property or copyright, or specialized information, both theoretical and practical, in areas such as search and examination with respect to patents and trademarks; computerization of industrial property office administration, use of computerized patent information databases, administration of the collection and distribution of copyright royalties; and promotion of innovative activities. Most of the training has taken place in developing countries and enabled large numbers of people from the Government and private sectors of those countries to learn about the subject of intellectual property and its role in the development process.

60. Advisory missions have been undertaken to provide advice to government administrations on improvements in the management of industrial property offices, the acquisition and use of computers, other equipment and documentation and the provision of better patent information services to the public. For planning and implementing such missions in a given country, WIPO relied on the country concerned for the identification of its needs with particular reference to local conditions. In return, WIPO offers expertise blended with experience gained from practical knowledge of the situation in other countries. This ensures that the advice and assistance are appropriate to the country in question.

61. In seeking to help developing countries to encourage domestic inventive activity, WIPO has offered advice in the drafting of legislative provisions for the establishment of suitable arrangements in favour of inventive activity and has organized conferences and seminars to discuss policy measures designed to support inventors in their endeavours.

62. As an executing agency for UNDP-funded projects, WIPO is involved in numerous technological capacity-building projects in developing countries, at the national and regional levels. These projects include the general areas of industrial property, copyright and neighbouring rights, and training and institution-building. Examples of new projects in those countries include:

Morocco. Modernization of the national industrial property system: 1990-1993 (UNDP $310,000).

Nigeria. Creation of a patent documentation centre within the National Office for Industrial Property: 1990-1992 (UNDP $200,000).

Regional. Establishment and strengthening of industrial property systems in Africa: 1987-1992 (UNDP $2 million).

World Meteorological Organization (WMO)

63. WMO works to strengthen national capabilities in meteorological, hydrological and allied sciences through education, training and research and the application of weather monitoring and forecasting technologies.

64. Atmospheric environmental science and technology has made and will continue to make progress as a result of the general coordinated effort of the scientific community, the growing concern of the general public, the economic and political aspects of the present and future state of the environment and the foreseen global consequences of human activity on climate, ozone depletion and acid rain.

65. WMO has a lead role within the system in studying both the physical and chemical state of the atmosphere and in promoting relevant science and technology. At the global level, the organization established the Global Atmosphere Watch (GAW) system to provide for necessary information and scientific assessment in order to unravel the changes in atmospheric composition (including carbon dioxide, ozone, other greenhouse gases, turbidity, solar radiation, chemical composition of precipitation and aerosols and many other atmospheric constituents) and the consequent effects on climate and marine and terrestrial ecosystems. No decision on the economic development of both developed and developing countries could be made now without a better knowledge of the causes and effects of environmental change and without an ability to assess the present or predict the future state of the environment affected by human activity.

66. In education and training, a new capacity-building trend is represented by the development of a WMO facility to assist member States in the training of personnel for national meteorological and hydrological services, particularly in developing countries. In this manpower development facility, the training needs of member States are determined and then matched with financial and training resources selected by WMO, so that training can be provided to specifically identified groups of operational personnel which have a common language and need the same skills at the same level.

United Nations Development Programme (UNDP)

67. A large number of developing countries emphasize science and technology as a priority area in their country programmes, and the number of projects emphasizing capacity-building in areas of science and technology - explicitly or implicitly - is growing. Most science and technology projects are related to institution-building and training in agriculture, industry, natural resources, energy,

education and communication. Research and development projects are the second largest category, but in a much smaller proportion in comparison to institution-building projects.

68. Capacity-building has been the most requested form of UNDP assistance in science and technology from the very beginning, and UNDP is expected to continue to emphasize this approach, which includes policy review and preparation, strategies and planning, establishment of science and technology related institutions, and networking of information systems.

69. The activities of the United Nations Fund for Science and Technology for Development (UNFSTD) continue to focus on five major areas, namely, (a) national science and technology policy and planning; (b) introducing new technologies and upgrading traditional technologies; (c) technology information; (d) technological innovation and entrepreneurship development; and (e) quality control and maintenance. Information on the activities of UNFSTD is given in document A/CN.11/1991/3.

70. Many countries tend to introduce technologies by establishing institutions outside of the context of macro-economic development. Selection of the kind and level of technologies has a marked influence on development and its sustainability. To pursue the effective transfer of technology, a joint interregional project on endogenous capacity-building in science and technology was launched in 1989 by UNFSTD and the Centre for Science and Technology for Development. While awaiting the project results, UNDP will continue to emphasize the concept of endogenous capacity-building in science and technology in the process of national development planning.

71. To ensure the maximum effect on national development efforts, the project seeks to ensure that Governments will develop the capacity to deal with science and technology in policy-making and planning in the context of macro-planning, assessment, selection, utilization and innovation of technologies, depending on the country's stage and level of development. A description of the progress achieved in the implementation of this project is given in document A/CN.11/1991/9.

72. The global programme of UNDP supports research on priority development issues of world-wide importance, concentrating on sustainable agricultural production and health problems of developing countries. In fact the programme consists mainly of projects related to science and technology. The largest global project currently being implemented by UNDP is centred on the International Centre for Insect Physiology and Ecology, Nairobi, and is aimed at field testing of integrated pest-management strategies. New activities include the development of technologies for pest management. UNDP contributions to this project began in 1986 and now total over $6 million.

73. The interregional programme is designed to spread and apply research results in certain sectors including science and technology, fisheries, health, water supply/sanitation, urban management, human resources, energy, trade and infrastructure, and to assist developing countries in obtaining increased benefits through multi-country cooperation.

World Bank

74. Assistance rendered by the World Bank in promoting science and technology for development is aimed at:

(a) Strengthening the capacity of developing countries to choose and adapt appropriate technologies for fostering sustained development;

(b) Supporting suitable financial mechanisms to increase research and development activities;

(c) Expanding training and research institutions to accelerate human resources development in science and technology.

75. Modalities for Bank assistance consist of technology components in Bank-financed projects or free-standing science and technology projects which are largely concentrated in the industrial and education sectors. Related economic and sector work and Bank policy advice contained in its ongoing dialogue with borrowing member countries also play a supportive role.

76. The following Bank-assisted projects approved during the period 1987-1990 are illustrative.

Brazil. A $150 million loan for a science and research training project will provide support for related programmes in such areas as biotechnology, chemistry, chemical engineering, environmental sciences and secondary school science education.

A $74.5 million loan will strengthen the capacity of the National Vocational Training System to improve and expand training, thereby increasing the responsiveness of skills training to rapidly changing technologies.

Korea. A third project ($50 million) in support of industrial technology development builds on the progress of prior Bank-assisted projects. Specifically, it strengthens the capacity of the Korea Technology Development Corporation to finance sub-projects proposed by enterprises for the importation, adaptation and development of industrial technology; assist staff development, particularly in upgrading appraisal and supervision capabilities for projects involving risk-sharing instruments.

Mexico. This loan of $48 million to support industrial technology development aims at reviewing instruments and related measures designed to encourage industrial technology development, strengthen technology infrastructure and metrology services and expand and improve the specialized financing programme of the Fondo de Equipamiento Industrial.

India. A $200 million loan will support measures to improve access by firms to foreign technology and more efficient domestic technology development. In addition, research and standards institutions will undertake research and development and other technological activities needed by industry, while small

innovative firms will be stimulated by the development of four venture-capital schemes.

Portugal. A loan of $32 million will assist the country in adapting its education and training system to the requirements of a modern economy. It focuses on rationalizing and strengthening university applied research to meet the needs of industry and agriculture, expanding polytechnic agricultural education, and introducing computers in primary and secondary schools.

77. At the in-house level, in 1987 the Bank appointed a Principal Adviser for Science and Technology who is directly involved in policy regarding operational work of the type illustrated above. The Bank also carries out in-house research on technology change and diffusion and the relationship between technology and human resources as it affects the development process.

78. In the area of human resources, lending for education in 1989 reached a record level of some $1.5 billion, which places the Bank in a very strong position in relation to the medium-term goals for lending in this sector recently set. The approved projects aim at improving the quality of higher education or technical skills, addressing issues at both the primary and secondary levels, and supporting national reform efforts in this sector.

International Maritime Organization (IMO)

79. IMO contributes to endogenous capacity-building through its technical cooperation programme in the training of personnel and the development of human resources, within the framework of the Strategy for Maritime Training. It supports a network of maritime training centres at the national, regional and global levels, including the World Maritime University in Malmo, Sweden.

80. The International Maritime Law Institute was inaugurated at Valletta, Malta, in October 1989. It provides qualified persons, especially from developing countries, with high-level facilities for advanced training, study and research in international maritime law.

International Telecommunication Union (ITU)

81. In regulation, standardization and development of telecommunications, the contribution of ITU to endogenous capacity-building in science and technology for development is centred on its operational activities. In this respect, one should note that there are practically no funds for technical assistance to developing countries in the regular budget of ITU. The major part of its technical cooperation activities are financed by UNDP, and ITU is the executing agency for almost all projects in the telecommunications sector. The remainder of the Union's activities are carried out under funds-in-trust and associate expert arrangements, which are financed by the recipient and donor countries. ITU activities include the training of personnel in all branches of telecommunications; organization of seminars and group training; establishment or expansion of institutions for professional and vocational training in telecommunications; and creation of test and development centres. For example, a regional project for the establishment of

an African advanced-level telecommunication training institute in Nairobi, Kenya, was initiated by ITU in 1985 and is due for completion in 1992. The project comprises a UNDP contribution of $2.6 million.

International Civil Aviation Organization (ICAO)

82. The ICAO Technical Assistance Programme, through the provision of technical experts, training fellowships and assistance in the development of national and subregional civil aviation training institutes, fosters endogenous capacity-building in civil aviation technology.

83. Of particular note is the Interregional TRAINAIR Programme, a global training resource-sharing network which, with ICAO support, is designed to assist the civil aviation training centres of the developing world to reach academic self-sufficiency.

84. The ICAO technical air navigation work programme provides a means by which civil aviation specialists from all member States can develop their knowledge of civil aviation technology. Through participation in specialized seminars and workshops and in world-wide air navigation conferences, civil aviation specialists participate in the review and updating of technical standards and consider related air navigation development.

C. United Nations Secretariat

85. At its thirteenth session in June 1990, the Committee for Programme and Coordination considered the evaluation of the United Nations major programme on science and technology and reviewed the progress report of the Secretary-General on the matter (E/AC.51/1990/4). The report covered activities under seven programmes of the medium-term plan for the period 1984-1989: Programme 1, Science and technology for development (Centre for Science and Technology for Development); Programme 2, Transfer of technology (UNCTAD); Programme 3, Science and technology in Africa (ECA); Programme 4, Science and technology in Europe (ECE); Programme 5, Science and technology in Latin America (ECLAC); Programme 6, Science and technology in Western Asia (ESCWA); and Programme 7, Science and technology in Asia and the Pacific (ESCAP).

86. The Committee requested the Secretary-General to submit to it in 1992 a report containing a conclusive analysis, with the contributions of the relevant bodies, identifying options for the future that would include action-oriented proposals for solving the problems identified in the assessments cited in the progress report, including those related to financing, institutional frameworks and any other problems associated with the implementation of the Vienna Programme of Action.

87. The science and technology programmes of the five regional commissions are well established within the programme structure of the regional units of the United Nations. The programmes of ECA, ECLAC and ESCWA are relatively small but closely related to other regional programmes dealing with such areas as industrialization, environment and natural resources, and constitute an important contribution to

endogenous capacity-building efforts of the United Nations. The programme of ECE is highly focused on issues of importance for European cooperation, including East-West transfer of technology. The programme of ESCAP has attracted an important volume of extrabudgetary resources and continues to support the Asian and Pacific Centre for the Transfer of Technology, a key institution established in 1977 in Bangalore, India.

Department of International Economic and Social Affairs

88. The Department provides overall assessments of socio-economic trends in developing countries, including the analysis of problems hampering the achievement of more stable and sustained growth. The annual World Economic Survey may be of particular interest in this regard. Another major document published by the Department - Report on the World Social Situation - addresses science and technology issues in relation to societal concerns. The periodically updated socio-economic perspective of the world economy deals more extensively with new technologies.

89. To assist developing countries in strengthening their capacity to apply science and technology, the Department organized, in co-operation with ESCAP and ECA, two Expert Group meetings on the acquisition of marine-surveying technologies, in Bangkok in 1985, and in Addis Ababa in 1987. The findings of the Expert Group have been published in two reports.

90. The primary objective of those meetings was to promote the capabilities to deal with marine resources, especially in relation to minerals, placer deposits and offshore hydrocarbons, as well as fishery resources and aquaculture. Great importance has been attached to the necessary institutional arrangements, both national and regional, and their ability to establish and sustain national technological capabilities to undertake cooperative arrangements with other countries of the region.

91. Assistance for endogenous capacity-building in developing countries is an important task of the United Nations. In the context of its regular work, the Department disseminates results of research and analysis on global economic and social issues and information on methodologies to national policy makers to assist them in the formulation and implementation of developmental policies. In science and technology, the contribution of the Department centres on statistics. Through its Statistical Office, it provides substantive support to the Department of Technical Cooperation for Development to strengthen the capabilities of developing countries in statistical data processing and informatics. In this context, countries are assisted in strengthening their general capabilities for processing statistical and related data through the use of new technologies, as well as enhancing capabilities for developing and maintaining specialized databases, taking advantage of emerging low-cost technologies.

92. As indicated in paragraph 194 below, UNESCO is responsible for the collection, analysis and dissemination of statistical science and technology data from member States.

Department of Technical Cooperation for Development

93. The Department has specific competence and carries out a large number of capacity-building activities in the field of science and technology for development. During the reporting period, some of these activities were particularly significant.

94. Within the framework of its activities in the area of development planning, the Department organized in February 1990 a national workshop on formulation of science and technology policy for development in Malawi, in collaboration with that country's National Research Council. The objectives of the workshop were to enable scientists, policy makers in Government and those in industry to exchange ideas on how science can best serve development in Malawi (one of the least developing countries) and also to enable workshop participants to institute modalities that will promote an effective interface between scientists and industrialists so that both should see their roles in the development of Malawi as complementary, and to alert local industrialists to the relevance of endogenously generated technologies to their activities.

95. The Department recently prepared a document entitled "United Nations Technical Cooperation Programme on the Exploration, Development and Efficient Use of Energy Resources" (E/C.7/1991/13) which will constitute the report of the Secretary-General to the twelfth session of the Committee on Natural Resources (25 March-4 April 1991). Among the issues discussed in the paper are: (a) creation of self-sustaining and lasting capacities in recipient developing countries; (b) training and the transfer of technology; (c) information flows in the energy sector; and (d) trends in technical cooperation in energy. The paper also provides a brief overview of the Department's technical cooperation projects and programmes in the energy sector by area, namely: energy policy, planning and conservation; petroleum, natural gas and coal; electricity; new and renewable sources of energy; and international meetings, technical and other publications, and energy planning software programmes.

96. Technical cooperation activities in the water resources sector have improved the capacity of geotechnical laboratories to design water structures, or research institutions to undertake physical and mathematical modelling of hydraulic problems, and has strengthened endogenous capacities in hydrogeological science and technology.

Economic Commission for Africa (ECA)

97. As part of the programme of ECA during the period 1990-1991, the Intergovernmental Committee of Experts for Science and Technology Development will hold its seventh session in November 1991 and will discuss ECA activities as described below.

98. In the area of policy and machinery for science and technology, ECA organized the third session of the Central Africa Working Group of the Committee, which identified three subregional projects. These and those identified earlier by the other subregions are being submitted to funding agencies to solicit financial

support. The subregional working groups have been instrumental in assigning adequate priority to science and technology activities and projects in the region.

99. With respect to the development of manpower for science and technology, ECA is finalizing a publication on review and appraisal of the performance of science and technology policy institutions in five African countries, and is embarking on similar exercise in six other countries. The publications will help Member States to reorient their policy institutions in science and technology.

100. The issue of management of science and technology was covered in a one-week training seminar for government officials, held in June 1990.

101. ECA is soon to begin a study on implications and potential for African countries of technologies on new materials, the results of which will be considered by a regional seminar being sponsored by the Centre for Science and Technology for Development early in 1991.

102. The concerns of women and technology were highlighted in a training workshop on the cultural prerequisites and the role of women in the application and development of science and technology in the African region in March 1990.

103. ECA has continued to execute the 1988-1992 $3.6 million UNDP-funded regional project, which provides assistance to the African Regional Centre for Technology in a programme for the strengthening of technological capabilities of the countries of the region.

Economic Commission for Latin America and the Caribbean (ECLAC)

104. The activities of ECLAC in science and technology during the period 1990-1991 will be focused on two projects which are just beginning and will take two years:

(a) The design of policies for strengthening the technological innovation capacity and increasing the international competitiveness of Latin American entrepreneurs: this project will use a series of research instruments to evaluate competitiveness, identify technological problems and select priority sectors in order to design action-oriented programmes. It will strive for recommendations on policies, trade opportunities and technical assistance projects;

(b) The design of mechanisms and actions in order to strengthen and develop the regional capital-goods industry through integration and productive complementarity between enterprises. In a first phase, the project foresees improvement in the diffusion of information between producers, engineering institutions and users of capital goods; in the second, the design of financial instruments, quality control, standards and other measures to encourage interregional trade and to improve the regional supply.

105. Such trends in ECLAC science and technology programmes are reflected in recent documents, as described in the following paragraphs

106. The document LC/G.1601 (SES.23/4) of 19 March 1990, entitled "Changing

production patterns with social equity: the prime task of Latin American and Caribbean development in the 1990s", was the main substantive paper at the Commission's last regular session. It includes some new system-oriented approaches in industrial and technological policies, formation of human resources, creation of enterprises and basic support services. With respect to the technological policies, emphasis is given to policy instruments related to changing productive patterns and bolstering an innovation system at national and regional levels. Thus, the technological policy would create conditions for assimilating technical progress across the board, on the one hand, and on the other, selective action and instruments in a limited number of fields in which it has been decided to reach excellence.

107. The documents "Instituciones mexicanas de innovaciones tecnologicas" (LC/R.827) by Mario Waissbluth (available only in Spanish) and "Estagnaçao e prosperidade: a modernizaçao industrial e tecnologica no Brasil" (LC/R.828) written by Jacques Marcovitch (available only in Portuguese), deal with specific cases of public and private institutions and enterprises in both countries.

108. In another study, Gérard Fichet shows how Latin American countries constrained their technological capacities during the 1980s and how the technological gap is growing not only with the industrialized countries but also with some East-Asian countries. He shows how the European community integrated its scientific programmes in order to obtain the necessary scale of human and financial resources. ("Dos decenios de ciencia y tecnología en América Latina y el Caribe", (LC/R.829), (available only in Spanish)).

Economic and Social Commission for Western Asia (ESCWA)

109. The current science and technology programme of ESCWA continues to emphasize the development of endogenous technological capabilities, transfer of technology, and promotion of cooperation in science and technology in the region. The new focus is on how to deal with practical problems, how to cope with new challenges, and how the countries concerned can cooperate in the application of new advanced technology.

110. Two aspects of interest in this connection are (a) the subjects being addressed, and (b) the strategy of their implementation. Concerning the first aspect, four new projects are being considered for the current biennium. They include three projects under the regular budget and one under extrabudgetary resources. Extrabudgetary activities are also envisaged in connection with the projects under the regular budget: (a) "Integration of science and technology into the development plans of selected ESCWA countries"; (b) "Development of technology services for research and development activities"; and (c) "Evaluation and implications of some recent technological advances for the economies of selected ESCWA countries". The extrabudgetary project is entitled "Development of indigenous capability in remote sensing technology through the provision of relevant education for educators".

111. Regarding the integration of science and technology into development plans: having conducted a number of studies and conferences in technology policies and

strategies over the past decade, ESCWA is now consolidating the information so generated by studying methods of including technology policy as an integral part of development planning. The objective is to shift the current exclusive concern with the supply of technology in the region to the generation of effective demand for local technological capability and creation of better conditions for linking the process of technology transfer to the process of developing endogenous technological capabilities. This programme element also aims to develop local capabilities in monitoring technological advances, evaluating their implications and assessing technologies that are appropriate for the conditions prevailing in the member countries. It also aims to train policy makers in the techniques of technology forecasting.

112. The second programme element is a continuation of an earlier activity of ESCWA which examined the linkages between research and development and the production sectors. The studies, discussions and recommendations that were generated by this activity concluded that special consideration should be given to the technology services needed to transfer the research results from the laboratories to the market-place.

113. The third programme element is also part of a continuing effort by ESCWA to enable the region to benefit from the ongoing global technological revolution. Having organized the First Arab Conference on Perspective of Modern Biotechnology in the Arab countries, in cooperation with a number of United Nations and Arab institutions, and having initiated a number of activities in micro-electronics and automation, ESCWA is now preparing to study the implications of new and advanced materials technology for the region. The importance of this subject stems from the fact that almost all ESCWA countries have natural resource-based economies. New advances in materials technology therefore offer both threats and opportunities to ESCWA countries, which requires careful analysis and evaluation.

114. Finally, the extrabudgetary project falls within the continuing effort of ESCWA to promote cooperation in the application of advanced technologies. This project is coordinated with the United Nations outer space programme, and financed exclusively from extrabudgetary resources from within and outside the region. The project aims at establishing a permanent link between the educational institutions in charge of remote sensing in the region and the advanced centres of technological progress in remote sensing world wide. The project will therefore help to bridge the knowledge gap that may occur because of "leap-frog" advances in this area.

United Nations Centre for Human Settlements (Habitat)

115. Habitat is carrying out its activities in endogenous capacity-building in science and technology within the framework of the Global Strategy for Shelter to the Year 2000, adopted by the General Assembly in resolution 43/181 of 20 December 1988. These activities deal with research and development, technical cooperation, and information and training. As analysed by Habitat, building materials and construction industries are still in a precarious situation in most developing countries in spite of their central importance to national development. A vast pool of technology is available which could be used by developing countries to lessen their dependency on imports and eventually attain self-sufficiency in

building materials and construction. The creation of effective mechanisms for technology collaboration among developing countries at regional and subregional levels and between neighbouring countries would bring the achievement of basic targets in indigenous production capacity within grasp. Habitat has promoted and sponsored research and development and disseminated its results regarding such fields as building materials and housing construction technologies and construction industry planning.

116. Habitat is conducting a series of subregional workshops involving policy makers, representatives from the private sector and non-governmental organizations as well as professionals (engineers, architects, city planners, urban sociologists) to discuss the formulation, implementation, monitoring and evaluation of national shelter strategies. The provision of rural and urban housing, taking into consideration appropriate technologies and the development of the indigenous construction sector, form an integral part of these workshops.

117. While many developing countries have initiated measures to reduce dependence on petroleum-based fuels and increase the use of new and renewable sources of energy, energy demands in human settlements cannot be met exclusively by renewable sources. To focus on specific technological options for the utilization of energy sources, both commercial and renewable, Habitat has directed its research to the use of new and renewable sources of energy, with emphasis on shelter requirements. Research publications are aimed at policy makers and energy experts responsible for defining energy strategies in developing countries.

118. Habitat promotes public transportation technologies and modes responding simultaneously to the needs of populations in developing countries for energy conservation, efficiency, productivity and environmentally sound development. It convened an Expert Meeting on Policy Options for Public Transport Modes in Cities of Over One Million in Developing Countries, which was held at Nairobi from 16 to 20 July 1990. In relation to technology options, the meeting recommended that (a) various transportation technologies and operation systems be considered to respond effectively and in an efficient way to differentiated travel demand and levels of affordability of transportation services in developing countries; (b) new technologies and modes being introduced should not divert attention from the improvement of existing ones; and (c) urban public transport development policies should be open to the application of various modes and technologies which, with economic and social changes and technological progress, may turn out to be most effective.

119. Technical cooperation activities have amply demonstrated the technological capacity-building dimensions of actions required at national and local levels in relation to the subjects of its research programmes. As an executing agency, Habitat implements projects funded by UNDP, national Governments, bilateral agencies, other multilateral organizations and funds-in-trust. During 1989, Habitat supported 267 projects in 102 countries. In the same year, 67 projects were approved and became operational, while 47 projects were completed. Approximately 20 per cent of the ongoing projects include elements related to housing and infrastructure technologies in human settlements, either as exclusive project objectives or as components thereof.

United Nations Conference on Trade and Development (UNCTAD)

120. The work of UNCTAD in the promotion of technology transfer includes (a) the economic, commercial and development aspects of intellectual property protection in the transfer of technology to developing countries; (b) improving the terms and conditions of technology transfer to developing countries; and (c) new forms of international cooperation in the transfer and development of technology.

121. A fundamental area of the work of UNCTAD in endogenous capacity-building is related to the strengthening of the scientific and technological base of the least developed countries (see para. 14 above). In pursuance of the Programme of Action for the Least Developed Countries for the 1990s, UNCTAD will continue to assist these countries, particularly to:

(a) Place adequate emphasis on science and technology in their national development plans;

(b) Find alternatives to the export of traditional raw materials by the development of new products and processes and thus ensure the competitiveness of the least developed countries' exportable goods.

122. Those trends in research and policy analysis have been integrated with the developmental dimension, particularly in technical cooperation work reflected in the substantive content and orientation of such activities as human resource development programmes, provision of technical support in specific sectors and design of national, regional and interregional projects. Among those activities are seminars organized for different regions, such as that held in February 1990 in Moscow on technology policy challenges and options for the developing countries of Asia; that held in June 1990 in Caracas on technology transfer and development perspectives in the 1990s for the Latin American region; and the substantive input on technology for the Second United Nations Conference on the Least Developed Countries, held in Paris in September 1990.

123. In addition, activities carried out on technology and international trade competitiveness have focused on the effects of technological change, including advances in new technologies on international trade, particularly on the export performance and possibilities of developing countries.

124. Two sets of UNCTAD activities are worth mentioning in this regard. First, the recent work on technology indicators, whereby the secretariat reviewed technology indicators in wide use for the purpose of examining their applicability to developing countries, particularly for assessing technology flows, the development of technological capabilities and the role of technology in trade performance. This review appears in document UNCTAD/ITP/TEC/19, which is under processing. It follows work on the subject which was carried out as early as 1986, with the preparation of part II of the Trade and Development Report, 1987 on "Technology, technology flows and international competitiveness". 6/

125. The second set of activities relates to statistical data on the reverse transfer of technology. Since the 1970s, efforts have been made to improve the

collection and dissemination of information on quantitative and qualitative aspects of the reverse transfer of technology (see documents TD/B/AC.35/13 and TD/B/AC.35/8). For the same purpose, UNCTAD has contributed to the international discussion on the establishment of an agreed set of definitions, principles, guidelines and standards on all facets concerning the reverse transfer of technology (see documents TD/B/AC.35/12 and TD/B/AC.35/7).

United Nations Centre on Transnational Corporations

126. As the focal point within the United Nations for all matters related to transnational corporations, the Centre deals with the activities of transnational corporations and their effect on a wide range of science and technology policy issues of particular relevance to endogenous capacity-building. It has published a number of studies consistent with this broad framework. Some of these are industry-specific (for example, Driving Force: The Global Restructuring of Technology, Labour and Investment in the Automobile and Components Industry); 7/ others are technology-specific (for example, Transnational Corporations in Biotechnology); 8/ and yet others are more general (for example, Transnational Corporations and Technology Transfer: Effects and Policy Issues). 9/ Among the major issues addressed in these studies are: the role of transnational corporations in the development, application and transfer of technologies; the mechanisms through which transnational corporations transfer technologies to developing countries and ways and means through which developing countries can acquire, adapt and innovate on technologies in a cost-effective manner.

127. The Centre has also published a study entitled Transnational Corporations and the Transfer of New and Emerging Technologies to Developing Countries. 10/ The study is premised on the fact that new technologies are increasingly being utilized in global operations of transnational corporations, including a number of new entrants in this area. While major technological innovations have taken place in most production and service industries, the study concentrates on four areas of new and emerging technologies which are likely to have the most extensive consequences: electronics and informatics; biotechnology and genetic engineering; new materials; and new, renewable energy technologies. The overall effect of such technologies is examined in relation to basic and critical issues such as international competitiveness, employment, locational and organizational implications and possible industrial restructuring. Several suggestions are made with respect to policies, programmes and institutional arrangements that may need to be considered by developing countries with a view to acquiring, adapting and effectively utilizing those technologies in furtherance of development objectives.

Outer Space Affairs Division of the Department of Political and Security Council Affairs

128. The uses of outer space are expanding steadily as a result of rapid technological development, and space technology offers a wide range of practical benefits. The Committee on the Peaceful Uses of Outer Space, the secretariat of which is the Outer Space Affairs Division, was designed by the General Assembly as the "focal point" for international cooperation in the peaceful exploration and use of outer space. This cooperation has long and successfully been promoted and

coordinated by COPUOS and its subsidiary bodies, along the lines recommended by the Second United Nations Conference on the Exploration and Peaceful Uses of Outer Space (UNISPACE 82).

129. In the report of this Conference (A/CONF.101/10, para. 430) and in General Assembly resolution 37/90, the mandate of the Programme on Space Applications of the Outer Space Affairs Division was expanded. It resulted in a variety of action-oriented activities, particularly in the area of short-term training courses, workshops, expert meetings, long-term fellowships for in-depth training and endogenous capacity-building. The overall goal of these efforts is that users in developing countries should not only be exposed to the application opportunities inherent in a given technology, but be enabled to contribute to the development process themselves.

130. For the activities undertaken by the Programme on Space Applications to strengthen the endogenous capacity of developing countries in the area of space science and technology, the specialized agencies of the United Nations as well as international governmental and non-governmental organizations are invited to co-sponsor the activities that fall within their respective areas of competence. For example, two recent meetings of experts on remote sensing applications (in Spain and the United Kingdom), organized by the Programme and financially supported by UNDP have resulted in remote sensing activities that are being implemented in the Africa and Indian Ocean regions in the period 1990-1992. The meeting of experts held in Spain has led to a joint United Nations/European Space Agency (ESA) activity whereby ESA will provide satellite data sets over selected sites in Africa that are within the coverage of the Fucino and Maspalomas ground-receiving stations. The meeting of experts held at Karachi, Pakistan, has led to three pilot projects on remote sensing applications that are being carried out in the Indian Ocean region. These pilot projects are being supported by the Government of France and by UNDP.

131. Activities such as workshops, courses, seminars and meetings of experts organized by the Programme on Space Applications (usually 6-8 per year) are sponsored by the United Nations, by other entities of the United Nations system and by the host Government of the country in which the activity is held. To provide in-depth training in basic space sciences, remote sensing, satellite communications and satellite meteorology, the Programme administered about 40 long-term fellowships. Details of all these activities are given in document A/AC.105/478.

132. The above-mentioned training and educational activities will be particularly emphasized during the 1991-1992 period, as part of International Space Year. The General Assembly, in its resolution 44/46, has endorsed the initiative of the international scientific community to designate 1992 as the International Space Year. The proposed activities focus on the use of space technology for studying and monitoring the environment under a major theme "Mission to Planet Earth". The activities to be conceived by the United Nations in the context of the Year are described in a publication entitled "Guide to the Participation of the United Nations in the International Space Year (ISY) - 1992" and in document A/AC.105/445 and Add.1-4.

133. At its forty-fifth session (resolution 45/72 of 11 December 1990), the General Assembly endorsed the recommendation of the Conference, that "the United Nations should lead, with the active support of its specialized agencies and other international organizations, an international effort to establish regional centres for space science and technology education in existing national/regional educational institutions in the developing countries". Funding for the establishment of these centres will be solicited from member States as well as from UNDP and other regional and international funding institutions. Details of the various aspects of proposed centres in Africa, Western Asia, Asia and the Pacific, Latin America and the Caribbean, can be found in documents SA/90/001-004.

134. The establishment of these centres should result in many multiplying effects and thereby:

(a) Contribute significantly to endogenous capacity-building in remote sensing, including satellite meteorology and environmental disciplines in each participating country;

(b) Enhance scientific and technical education in each participating country and region;

(c) Enhance the quality and quantity of contributions of graduates towards the overall development of their respective nations and towards the management of their countries' resources ard environment;

(d) Strengthen the capabilities of institutions of higher learning and national and regional remote sensing user assistance and training centres;

(e) Assist user agencies in member States to strengthen their capabilities in the use of remote sensing for the management of the natural resources and environment of those countries.

IV. TECHNOLOGY MONITORING, ASSESSMENT AND FORECASTING

A. Introduction

135. For the purposes of discussing system-wide activities in this area, technology "monitoring" is assumed to be the systematic scanning and organization of information on technological developments. "Assessment" is treated as the whole scope of evaluation of the consequences (usually different from those primarily intended) of technology - espacially in its social context - on the environment, trade and employment. Forecasting, or the prospective study of technologies, is a relatively recent activity which seeks to envisage the future impact of technological events in terms of alternative scenarios, constructed through the use of expert judgement, modelling techniques and simulation systems.

136. The above three elements are considered to be closely interrelated and complementary, and to constitute important factors in the process of managing technological change, particularly as it relates to decisions on economic and

social development strategies, technology alternatives, sectoral investment and research policies.

137. In October 1989, the General Assembly entrusted the Centre for Science and Technology for Development, through the Advance Technology Alert System and in cooperation with other United Nations bodies, to serve as the focal point for technological assessment within the United Nations system and, where possible, for relations with Governments and non-governmental organizations concerning technological assessment activities in Member States.

138. In a closely related decision, the Economic and Social Council, in July 1990, requested the Secretary-General, in consultation with the Administrative Committee on Coordination, to designate the Task Force on Long-Term Development Objectives of the ACC (to which the Department of International Economic and Social Affairs provides the chair and secretariat) as the focal point for the mutual exchange among agencies of assessments of prospective developments in the economic and social fields, in order to improve existing mechanisms for disseminating socio-economic forecasts and projections in a comprehensive and readily accessible form.

139. Programmes and activities in short, medium and long-term technology assessment and forecasting, using state-of-the-art methods (such as interactive expert group judgement, dynamic cross-impact modelling, alternative scenarios and computer-based simulations) are just beginning to appear within the United Nations system. These activities generally seek to develop in-house and cooperative technology assessment and forecasting research in the respective organizations' field of competence, and to assist Member States in the development of their own assessment and research capabilities.

B. United Nations system activities

United Nations Industrial Development Organization (UNIDO)

140. UNIDO plays a pivotal role within the system in activities relating to technology monitoring, assessment and forecasting, since it deals with the whole gamut of contemporary technologies. In the area of technology policy, in the light of experience gained in the past few decades, UNIDO has reviewed the issues raised by world-wide economic and industrial trends and the fact that technology policy must be integrated with overall industrial and development policies. In order to develop an integrated programme of UNIDO activities on technology policy, a working group has been established under the chairmanship of the Deputy Director-General, Department of Industrial Promotion, Consultations and Technology, assisted by a high-level consultant and including senior representatives of the various departments of the UNIDO secretariat. The working group intends to draw also on the experience of various research policy institutions working on this subject and interested members of the United Nations Advisory Committee on Science and Technology for Development.

141. In the programmes and activities of UNIDO, which deal with the broadest array

of industrial technologies, technology forecasting is included under the more general concept of technology management and particularly in terms of building the capacity of developing countries to manage technological change. Activities in this respect are aimed at assisting developing countries in the management of technology at the subsectoral and plant levels, as well as in supporting the objectives of industrial reactivation programmes.

142. UNIDO publishes three "Monitors": on Genetic Engineering and Biotechnology, on Microelectronics, and on Advances in Materials; it will shortly publish a fourth on Marine Industrial Technology. However, these monitoring activities should be strengthened and complemented by an analytical tool involving synthesis of the implications of ongoing technological developments. That implies an understanding of long-term cooperative research and development agreements between technology producers, and interpreting technology strategies of transnational corporations and other potential sources. Technological intelligence is a necessary service to provide answers to specific technological questions from Governments or enterprises. It should enable strategic decision-making by putting together for a product or process the main aspects of the technology market, the corporate strategies of producers and users of a technology, trends in technology, trade and investment flows, market opportunities and government policies. Preliminary work has been undertaken by UNIDO for a pilot programme to establish industrial technology intelligence (INTELL) mechanisms in the food-processing industries of three Latin American countries.

143. With regard to the various aspects involved in creating a basic technological infrastructure in developing countries, the new approach adopted is to view these issues in the context of overall technology management. The activities in this respect aim to assist developing countries in handling technology components at the subsectoral and plant levels and as a support to industrial reactivation. UNIDO is also currently collaborating with the Centre for Science and Technology for Development to promote the concept of technology missions, which represents a relatively new tool for solving socio-economic problems requiring technological input.

144. Another concept being developed is that of technology gain. It arises from the fact that whether in technical cooperation activities with Governments or in enterprise-to-enterprise cooperation, it is desirable to ensure that the activities of technology transfer are carried out with maximum effectiveness for the recipient country. Two main aspects will be examined:

(a) Appropriateness of the technology to be assured not only from the technical and economic points of view (a technically correct solution in the light of existing technological alternatives as well as the needs of recipients, with minimum cost and delays), but also taking into account the social, environmental and energy-saving considerations, for example. Linkage with other parts of the industrial system will be required to best use and develop certain capabilities. A set of technology assessment criteria that can be applied at the design and evaluation stages will be developed using UNIDO experience as a basis;

(b) Maximum effect on technological development by introducing a number of

features in technical assistance projects and enterprise-to-enterprise cooperation activities with the aim of achieving some permanent technological gains for the recipient country.

145. The Industrial and Technological Information Bank (INTIB) has developed into an automated information system operating at the international level and consisting of a network of national focal points (NFPs) in 70 countries. NFPs are responsible for the acquisition, processing, storage and dissemination of national industrial and technological information. They interact with INTIB, which coordinates their activities, provides them with information resources and sponsors the training programmes for their staff.

146. INTIB has organized or supported the activities of regional focal points in Europe, Asia and Africa. It intends to integrate its efforts with ongoing activities at national, regional and international levels and not to create a super-centralized global information structure. The network promotes the joint activities of INTIB, NFPs, nodes, information suppliers and those who participate in industrial technologies' selection, evaluation and implementation. INTIB generates special databases to provide for all of these processes and also analyses the practicality of modern and low-cost means and telecommunication tools which use personal computers for information accumulation, transmission and retrieval. The INTIB telecommunication efforts lead to interaction with NFPs in the real-time mode.

147. The Technological Information Exchange System (TIES), which began as part of the technology acquisition activities, has now developed into an independent information-sharing network for developing countries to assist each other in evaluating terms and conditions of technology transfer agreements. Its membership traditionally consisted of government institutions responsible for technology acquisition, negotiation, monitoring and registration. TIES is now in the process of reaching out beyond traditional membership and is expanding its cooperative links with institutions and organizations such as science and technology development centres, industry associations, research institutions and professional societies.

148. The International Centre for Genetic Engineering and Biotechnology was founded in 1983 as an intergovernmental organization with components in Trieste and New Delhi, for the purpose of providing training facilities for scientists from developing countries as well as access to the frontiers of the discipline through research and development activities. Pending the entry into force of the Statutes, the Centre is being run through a series of projects by UNIDO. Main support is provided by the Governments of Italy and India, with funds close to $50 million for a five-year programme. It has also begun to attract interest from funding agencies, foundations and enterprises. It is expected that the Centre will train over 100 scientists for two-year periods during the five-year programme, besides a large number of scientists through short-term courses. A special feature of the Centre, which as of August 1990 had 43 members, is a growing network of affiliated centres (as of August 1990, 13) with which it interacts and which it supports by collaborative research grants. Member countries of the Centre have also begun examining issues related to biotechnology safety, exchange information and possible

harmonization of guidelines in that respect. Safety issues are also considered by UNIDO under an informal UNIDO/WHO/UNEP/FAO working group. UNIDO has initiated an activity to develop a voluntary international Code of Conduct on the release of genetically engineered organisms into the environment. In this respect, it is cooperating with the Informal Working Group and also with the Secretariat for the United Nations Conference on Environment and Development.

149. Preparations for the establishment of the International Centre for Science and High Technology continued in 1990 and a new project leader at the Assistant Secretary-General level has been appointed by UNIDO. The Centre would be comprised of three institutions: Chemical Sciences; Materials Sciences and High Technologies; and Earth and Environmental Sciences and Technologies. It would be located in Trieste. Its purpose would be similar to that of the International Centre for Genetic Engineering and Biotechnology. The Italian Government has made available substantial funds for the preparatory phase and a two-year pilot phase. The Centre is under rapid development. As high technology is based on the results of research at the frontiers of science, the Centre will promote the building of advanced scientific research capacity for developing country scientists.

150. The Regional Network on Micro-Electronics for Latin America was proposed in 1985 as a mechanism to set up cooperation activities among different Latin American scientific and technological institutions in the area of micro-electronics and its applications. Institutions in 15 Latin American countries participate. A project funded by UNDP is under implementation. It is expected that a major project will be approved by UNDP for the next programming cycle after 1991, allowing regional cooperation to develop fully.

151. At the request of Brazil, a project has been developed for the preparatory phase of promoting the establishment of an international materials assessment and application centre. It is currently with the Brazilian authorities awaiting their decision. The project was formulated on the basis of the results of an expert mission to selected countries and institutions and included an expert from Brazil. The mission received a great deal of positive response, both at the individual and institutional levels, for the establishment of a multi-disciplinary techno-economic international materials assessment and application centre. The mission has underlined the fact that materials issues are today multi-disciplinary in nature and trans-material and trans-sectoral in effect. There is a need for the developing countries, at both the government and enterprise levels, to be aware of the problems related to the techno-economic aspects of materials transitions, and the capabilities to manage such transitions. According to the mission, the functions of the Centre should include assessing and disseminating information on materials, studies on scientific, technological and industrial trends, specially commissioned and specialized studies of a techno-economic nature, workshops, education and training, advisory services, intermediation, and promotion of international cooperation.

152. To explore and exploit the resources of the sea, a concept of "centres of marine industrial technology", at the regional/subregional level, has been developed. Action is already being taken to promote such centres in the Mediterranean and Caribbean regions. Contacts are maintained with the United Nations Office for the Law of the Sea and UNEP in regard to those activities.

153. A Consultative Group on Solar Energy Research and Application has been established to review at the global level the trends in this area and provide guidelines to developing country institutions in formulating projects for obtaining funding. The aim of the Group is to develop an association of donors so as to promote more effective programming and funding of research projects and eventually the augmentation of the volume of funding itself.

154. Environmental Technology (ET) is a newly emerging programme designed to assist developing countries in introducing waste treatment, disposal and recycling elements into their industrialization efforts and to harness new developments in cleaner technologies. This major promotional programme will comprise commercialization schemes and programmes for advanced research in clean technologies and pollution control/monitoring technologies and methodologies developed by research institutes of developing countries, as well as a public awareness programme. The ET programme will undertake preparatory work for the organization of an international conference on pollution prevention and clean technology, as well as for the publication of a technical guideline series in pollution control and cleaner technologies. It will function as an information desk on waste material recycling and recovery of energy and will also issue commercial publications of scientific papers on technologies and methodologies for minimizing risk in industrial environments. Under ET, UNIDO expects to organize an international workshop on issues and strategies relevant for the introduction and application of cleaner and energy-saving technologies. Finally, it will carry out technology assessment in the form of global projects in selected sectors.

Economic Commission for Africa (ECA)

155. The work of ECA in the field of technology monitoring, assessment and forecasting is engaged at two levels: global/horizontal and sector/vertical.

156. At the global level, the Science and Technology Section promotes science and technology institution-building in which monitoring, assessment and forecasting are important functions in guiding the formulation of research and development priorities and technological choices in transfer activities. The Section also sensitizes decision makers to the emergence of new materials technologies and biotechnologies and their effects on traded commodities.

Economic Commission for Europe (ECE)

157. The programme of ECE on science and technology in Europe is implemented by the Senior Advisers to ECE Governments on Science and Technology. In their study of developments in national science and technology policies, the Senior Advisers have undertaken in-depth quadrennial reviews of national developments. For the last of these, undertaken in 1988, 22 Governments produced national monographs. 11/ The next review is scheduled to be undertaken in 1992. Also related to science and technology policies, a Seminar on the Role of Long-term Forecasting in the Formulation of Science and Technology Policies was held in Prague in October 1990.

158. The second area in which work has been undertaken relates to the evaluation of research and development. This work originated with a seminar on the evaluation of

research and development which was held in Prague in November 1981. 12/ This was followed by ad hoc meetings which were held in Prague in 1984 and Helsinki in 1987, and by a Seminar on Evaluation in the Management of Research and Development which was held in Madrid in April 1989. 13/ The Seminar, which was attended by experts from 22 member countries and several intergovernmental organizations, produced a number of conclusions and recommendations. During the Seminar, participants placed particular stress on the fact that the use of the results of evaluations as a tool in strategic forecasting, planning and management, as well as in assessing effectiveness was an important basis for the management of research and development. They also considered that there was a need for research on evaluation and for the exchange of experience and cooperation at the international level in order to improve the methods and indicators used and the institutional arrangements for evaluation, and to facilitate the exchange of knowledge on socio-economic effects of national research and development programmes and mission-oriented research.

159. Other important work in the current programme of work of the Senior Advisers includes the development and maintenance of an inventory of national safety guidelines in biotechnology, for which a series of national monographs have been issued in a special derestricted document series, 14/ and selected work on the predicting of earthquakes, on which a seminar was held in Lisbon in 1988. 15/

160. Both the work of the Commission at large and that of the Senior Advisers on Science and Technology have been influenced by a number of important regional and global developments. Although not exhaustive, some of the most important developments include:

(a) Developments in science and technology and world priorities; raw materials; natural resources, including energy resources; environmental considerations, including global warming; and natural and man-made disasters;

(b) Government priorities as reflected in, for example, the Final Act of the Conference on Security and Co-operation in Europe and the follow-up meetings held in Belgrade (1975), Madrid (1980-1983) and Vienna (1987-1988);

(c) Report of the World Commission on Environment and Development (the "Brundtland Report") and the outcome of the regional conference held in Bergen in June 1990;

(d) Activities in other forums: the Commission of the European Communities (CEC) and the Organisation for Economic Co-operation and Development (OECD).

Economic and Social Commission for Asia and the Pacific (ESCAP)

161. ESCAP has carried out significant activities in the area of technology monitoring, assessment and forecasting. Under the subprogramme on "Monitoring major breakthroughs in science and technology", work was completed for a publication on the technological, economic and social effects of powder metallurgy and its applications in the region. In cooperation with UNIDO and the Centre for Science and Technology for Development, a project document was prepared on the formulation of a regional plan of action in the area of new and advanced materials.

162. In new and emerging technologies, exchange visits between China and the Republic of Korea have been organized. A project is also being prepared on standardization, testing and quality control of new materials, to be supported by the Republic of Korea and China. A project on a workshop crew study tour on biotechnology was implemented in 1990 in cooperation with the International Centre for Genetic Engineering and Biotechnology.

163. The Asian and Pacific Centre for Transfer of Technology published in 1989 a six-volume comprehensive study on technology substitution entitled A Framework for Technology-based Development, under the ESCAP Technology Atlas Project.

World Intellectual Property Organization (WIPO)

164. Since the 1970s, WIPO has carried on a certain number of activities specifically aimed at promoting inventive and innovative capacity in science and technology in developing countries, such as:

(a) Facilitating exchange of knowledge and practical experience on the promotion and management of inventive and innovative activity among institutions and experts in developed and developing countries;

(b) Assistance in the creation and strengthening of national and regional inventors' associations;

(c) Encouraging inventors and innovators through the WIPO award programme;

(d) Facilitating the transfer of inventions and new techniques from inventors and research and development institutions to potential users of technology through assistance in establishing support structures for inventors and/or organizing inventors exhibitions or contests;

(e) Study and assessment of actual situation and experience with respect to promotion of inventive and innovative activity in various countries and regions and the preparation and publication of relevant studies.

165. The WIPO awards programme for inventors was initiated in 1979. The purpose of the awards is to promote inventive and innovative activities, particularly in developing countries or for their benefit. The medals are awarded at exhibitions or contests organized by national or international institutions. From the start of the programme to 31 August 1990, a total of 215 medals were awarded to inventors and promoters of inventive activity from 52 countries, including 24 developing countries.

166. In 1988, WIPO initiated the establishment of two special WIPO awards to encourage inventors from Africa to concentrate their efforts on the search for inventions in specific areas of technology and on solutions useful to environmental protection. The first special award was created jointly with the Organization of African Unity (OAU) and the second, jointly with UNEP and the Union of African Journalists (UAJ).

167. WIPO publishes studies and monographs on national experience in the promotion of technological innovation. So far, studies on the experience of the Philippines (WIPO/INN/S/1) and on the experience of Egypt (WIPO/INN/S/2) have been published.

168. To enhance the use of the industrial property system for the promotion of technological innovation, in other words to bring the invention from the desk or laboratory of the employee researcher to practical use in industry and to the market, WIPO published in 1989 Guidelines for the Management and Exploitation of Patented Inventions of Research and Development Institutions in Developing Countries. 16/

169. Patents are a key source of information on new technological developments, and thus the monitoring of patents is essential to technology monitoring, assessment and forecasting. In this connection, WIPO is involved in a number of new projects on technology information systems using patent data.

170. WIPO seeks to encourage and institute close cooperation among national and regional industrial property offices, and among such offices and the International Bureau of WIPO, in all matters concerning patent, trademark and industrial design documentation and information. This includes in particular the standardization of documents and the indexing and classifying of patent documents in order to facilitate retrieval of the information contained therein, establishment of the state-of-the-art and search for the purposes of patent examination. It is expected that these activities will make the collecting, storing, handling, searching and exchanging (among industrial property offices) of documents and information covering inventions, trademarks and industrial designs cheaper, simpler and more efficient.

171. To this end, the WIPO Permanent Committee on Industrial Property Information, its Executive Coordination Committee and its working groups are concentrating on:

(a) Monitoring the development and effect of new electronic data-processing methods in order to determine the relevance of those methods in the area of industrial property documentation and information;

(b) Making corresponding recommendations to industrial property offices, particularly in respect of the standards to be applied and systems to be established by them for the formatting, storage and retrieval in electronic form of industrial property documents and information;

(c) Making suggestions on the most effective means of disseminating such documents and information to other industrial property offices and to users in general, especially in the light of the needs of users in developing countries for industrial property documentation and information.

172. WIPO publishes statistical information on applications and grants of industrial property titles (patents, trademarks, industrial designs, utility models) which are a very useful tool for analysing trends in research and development activities in specific technological areas. The annual industrial property statistics are also used to forecast future developments in various areas of technology.

173. WIPO offers free-of-charge patent information services, supported by agreements concluded between WIPO and contributing industrial property offices in industrialized countries. Those information services include the provision of confidential state-of-the-art reports in response to requests received from institutions or individuals in developing countries (requests initiated by private institutions or companies or by individuals require the endorsement of a government authority). Such reports identify the state of the art in respect of a technical problem described in the request as reflected in patent documents and in relevant non-patent literature. The search is performed by highly skilled specialists of industrial property offices in their collections of patents and published patent applications as well as relevant non-patent literature. Some searches are performed in, or assisted by reference to, computer databases outside industrial property offices, several of which are available for on-line searching.

174. In order to facilitate administration of the industrial property system, WIPO has initiated a programme for international cooperation in the search and examination of patent applications. Examination of the patentability of an invention requires enormous documentation and a large staff of highly qualified and specialized engineers and lawyers. Most developing countries and many developed countries cannot afford the costs of such documentation and staff. This programme enables the industrial property offices of developing countries to rely on highly qualified professionals and the experience of patent offices in industrialized countries in the processing of decision-taking with respect to national patent applications.

Food and Agriculture Organization of the United Nations (FAO)

175. As understanding of agricultural problems has grown, the focus of research to solve them has shifted (see table 2). Past research has tended to favour exportable cash crops, superior grains such as wheat and rice and, in general, production on the agro-ecologically more favourable land areas. An additional need is to address the problems of resource-poor farmers and of more marginal areas, particularly in the context of sustainable development. Other needs are to ensure consideration of the effects of the application of research results on social equity and attention to the technological needs of women for their agricultural, household and marketing activities.

176. FAO has accumulated vast experience on the management of agricultural technology change. Its views reflect this experience. Government administrative offices need guidance, a technology policy and strategy for technology acquisition linked to national development plans. FAO assists in the formulation of those guidelines in its sectors on food and agriculture, fisheries and forestry. A forward-looking strategy must identify the technologies that will satisfy the needs of future development. To the extent possible, these needs should be met from within the nation, but even technology introduced from outside needs to be assessed, first for its general suitability and subsequently for its performance in use.

Table 2. The shifting focus of agricultural research and development

Past objective	Additional emphasis
CROPS	
Non-food and cash crops	Upgrading subsistence food crops
Large-scale producers	Small-scale producers
Prime land	Marginal land
Increased productivity	Sustainable production
Higher-yielding cultivars	Stress-resistant cultivars
Mechanization	Animal traction
Monocultures	Intercropping
Irrigation	Rain-fed agriculture
Mineral fertilizers	Nutrient recycling
Chemical pesticides	Integrated pest control
Limited number of crops	Crop diversification
LIVESTOCK	
Cattle	Small ruminants and other small livestock/poultry species
Large-scale producers	Small-scale producers
Traditional pastures	Improved dryland pastures
Capital-intensive production	Extensive production Improved food quantity and quality
FISH	
Off-shore fisheries	In-shore, inland fishing, aquaculture
Increased production	Replenishment of stocks Increased fishing efficiency Lower post-harvest losses
Development of boats and gear	Improved monitoring of resource stocks Enhancement of marine environments Alternative energy propulsion
TREES	
Single species plantations	Multi-purpose tree crops
Industrial forestry	Community forestry, agroforestry
Harvest mechanization	Animal traction Trees for watershed management Trees for environmental improvement Management of protected areas Tree products for women

Source: The State of Food and Agriculture, 1987-1988: Changing Priorities for Agricultural Science and Technology in Developing Countries (Rome, Food and Agriculture Organization of the United Nations, 1988).

177. Much of the field programme of FAO has as its major concern the practical assessment of the suitability of agricultural, fishery and forestry technologies under given economic, social and environmental conditions. This applies not only to projects dealing with food production and the management of natural resources, but also to the numerous activities in institution-building for rural development, as the worth of such institutions will often be known by their capacity for technology assessment. Consequently, FAO lays great stress on providing training and information for the technical cadres of pertinent institutions in awareness and testing of existing and new technologies. The publication of FAO Research and Technology Paper 1 entitled, "The technology applications gap: overcoming constraints to small-farm development", provides the information and criteria needed for improving food production on small holdings and in areas with marginal production potential. These efforts are supplemented by close liaison with international research centres.

178. FAO contributes to greater awareness of existing and new technologies and of efforts made to test those technologies. The main means utilized for this purpose are AGRIS and CARIS. AGRIS, the Agricultural Information System, collects relevant information from over 140 participating countries and 19 regional and international centres, stores the information in English, French and Spanish in a computerized database with close to 2 million entries (1990), and disseminates the new information through a monthly "AGRINDEX" of some 10,000 entries. CARIS, the Current Agricultural Research Information System, is a continually updated register of relevant projects in about 80 developing countries, information being supplied and dissemination ensured through its 115 national and regional member centres.

179. With regard to the theme for the eleventh session of the United Nations Intergovernmental Committee on Science and Technology for Development, namely, "environmentally sound technologies", FAO views environmental concern as one important component in assessment of technology. Under this umbrella, economic viability, social acceptability and technical feasibility - and indeed environmental effects - must also be considered.

International Labour Organisation (ILO)

180. ILO programmes and activities in science and technology monitoring assessment and forecasting cover two major areas: (a) anticipation of the employment implications of technological change, including productivity-enhancing effects of new technologies; and (b) assessment of the potential effects of new technologies on working conditions and working environment.

181. In the area of new and emerging technologies, the ILO work programme focuses on biotechnology, micro-electronics and robotization.

182. Despite the steady growth of scientific literature on biotechnology in the rural sector, little systematic attempt appears to have been made at a comprehensive examination of the issues in a social science framework. A preliminary analysis of the scientific character of the bio-revolution reveals that it contains both pro- and anti-poor elements. Although the scope for exploiting the pro-poor elements is greater, the corporate sector, through its sheer economic

muscle and for its own commercial interests, is vigorously pursuing strategies, both technological and institutional, whose outcome may be anti-poor. The pro-poor features of the bio-revolution that have been identified include a reduction in the farmer's cost of production which is expected by eliminating dependency on petrochemical input created by the green revolution and wider geographical spread which can be expected to increase food availability and boost purchasing power of the poorest populations in neglected areas who were the biggest losers from the green revolution.

183. ILO studies reveal that new microelectronics-related technologies can reduce labour requirements per unit of output, which may pose critical problems for some countries with high unemployment rates. However, there has been an exaggerated emphasis on the negative employment effects of those technologies. The research shows several important findings. First, the rate of diffusion of new microelectronics-based technologies has been far slower than had been anticipated. Secondly, the use of such technologies usually involves adjustment processes and their direct employment effects are not immediate. Thirdly, the magnitude of the usually negative direct employment effects varies significantly across sectors and even across firms (for example, it is significant in some cases such as in the central data processing of banks and other service industries, but moderate and even negligible in other areas of work). Fourthly, the negative direct effects are, in many cases, partly compensated by positive indirect effects on output and employment - for example, as a result of new products and services which are made possible by the new technologies or as a result of cheaper and/or more competitive products.

184. For computer-aided design and manufacturing (CAD/CAM), increases in output per worker ranging from 100 to 3,000 per cent have been reported for many different applications, although most studies do not mention the time-lag involved. In general, the evidence available so far suggests that, in the short and medium term, CAD/CAM does not reduce employment, and does in fact increase the demand for programmers and designers with skills in computer graphics, due to learning adjustment effects in the short term and work amplification effects in the medium term.

185. The scenario on the socio-economic consequences of robotization is quite different across countries, sectors and firms, as suggested for example by a synthesis of ILO studies of the automobile industry in both industrialized and developing countries. The effects of robotization depend on the uses of robots and the type of labour they displace. In some cases it contributes to a reduction of working time, but elsewhere it displaces workers, partly to other production activities in the same firms.

186. ILO activities on the working environment include (a) policies for the protection of workers privacy; (b) occupational stress associated with new technologies; (c) job content and new technologies; (d) work-life in transition; (e) effects of new technologies on home work (a specific category of workers (telework)); and (f) occupational safety and health issues arising from the application of new technologies.

187. A manual is being prepared on the design of machines, equipment and work-stations, improved work organization, appropriate ambient conditions, the introduction of group work and multi-skilled jobs, and techniques for worker involvement. Particular emphasis is being placed on low-cost improvements and on measures of direct relevance to developing countries. The manual is intended for the use of both managers and workers and their representatives. In addition, the manual will use illustrated case-studies to provide guidance on measures which help to ensure the smooth and effective application of new technologies.

188. It is now widely recognized that organization of work is as important as new technology in determining the effects on employment, skills and conditions of work. A thorough review of developments over the past two decades concerning new forms of work organization in industrialized countries is being carried out.

189. ILO, in cooperation with the Swedish Work Environment Fund, is currently examining the nature of recent changes in the work-place and the forces that are shaping those changes. The result will be a report to be submitted to an international meeting of policy makers in mid-1991. The objective of the report, and of the meeting, is to stimulate national and international debate and action.

190. An international group of experts, which includes employer and trade union members, is preparing an interdisciplinary analysis of the changing nature of work and the strategies that could make it more productive as well as more fulfilling for workers. Their work covers three main topics: (a) the forces which are shaping the future, including technology, business developments and labour market developments; (b) current experience in both advanced and typical work settings, together with modern evidence on design of work; and (c) policy options for Governments, employers and trade unions.

191. ILO is evolving policies for occupational safety and health in the following areas of new technologies: (a) man-made mineral fibres; (b) biotechnology; (c) robotization; (d) chemicals; and (e) dismantling of nuclear power plants.

192. As a result of a Meeting of Experts on Safety in the Use of Mineral and Synthetic Fibres, recommendations have been made for a code of practice on man-made mineral fibres to deal with health effects, national and international regulations and practice related to safety, and appropriate work practices and control measures for the protection of workers' health.

193. A study is being prepared by ILO on the effects of modern biotechnology, including gene technology, on workers' health and on the environment. The study will identify potential risks related to the introduction of such new technologies and will serve as a basis for future work on preventive measures.

194. An ILO study on safety in the use of industrial robots gives basic guidance on design and use. The study gives a comparison of national regulations and recommendations on the main measures to be taken to prevent accidents and injuries.

195. The annual production and consumption of chemicals, currently estimated at 400 million tons, continues to increase, causing world-wide concern over the

hazards to workers and the quality of the environment. New ILO instruments on safety in the use of chemicals at work specify provisions for action at the national and enterprise levels. The instruments require the setting up of national systems of criteria and systems for the classification of hazardous chemicals. Recalling that different systems of classification exist both at national and international levels, the seventy-sixth session of the International Labour Conference (1988) called on the ILO to promote the harmonization of national and regional classification and labelling systems for the use of chemicals at work. ILO proposes to prepare a set of criteria as a basis for an international harmonized system of classification within the framework of the UNEP/ILO/WHO International Programme on Chemical Safety (IPCS). The work will be carried out in cooperation with the European Communities, the Organisation of Economic Cooperation and Development and various national and international institutions. In consultation with those specialized institutions and bodies and with the organizations and bodies of the United Nations system, ILO will set up simplified classification procedures for hazardous chemicals. The results of this work will be the basis for future classification and labelling of hazardous chemicals.

196. Proposals for future work plans of ILO include studies on the safety and health implications of the dismantling of nuclear power plants during the 1990s.

United Nations Educational, Scientific and Cultural Organization (UNESCO)

197. Monitoring, assessment and forecasting of scientific activity are inherent to the mandate and objectives of UNESCO. The General Conference, when approving in 1989 the orientations for the medium-term plan (1990-1995), recalled the organization's mandate and role within the United Nations system with regard to the furtherance of basic and engineering sciences and their application to development, and stressed the interdisciplinary nature of its activities in the scientific, technological and environmental areas, and the need to secure and strengthen the contribution of the social sciences to those activities.

198. In 1961, UNESCO published a celebrated review of the state of scientific arts, Current Trends in Scientific Research, 17/ which was a reflection of the cumulative scientific and technical character of the times and provided a stocktaking of the scientific and engineering disciplines in the post-Second World War period. In 1977, a major study was published by UNESCO under the title The Scientific Enterprise, Today and Tomorrow. 18/ It was an examination of man's condition during the "Golden age of science" and the human implications of scientific advance. Scientific Forecasting and Human Needs: Trends Methods and Message, 19/ published in 1984, represented a variety of approaches to scientific forecasting, dealing with methodological problems, experiences of national and international projects, and trends in scientific and technological developments and their effects on society.

199. A new development in the UNESCO Science, Technology and Society Programme was the creation of the International Scientific Council for Science and Technology Policy Development, which held its first session at the end of 1988. The Council advises UNESCO on its programme and activities of research training and information exchange in the field of science and technology policy and research and development

management. The need for changing the traditional modes of management of scientific and technological development, which tend to rely on hierarchies of priorities, objectives and projects, for example, has been recognized by policy makers. Science is viewed more as a strategic resource in a market and process-oriented framework, which operates effectively on the basis of decentralized responsibility and far-ranging alliances with people and institutions outside a researcher's own sphere of responsibility. The recommendations of the Council were reflected in the UNESCO programme for 1990-1991, and a second session is planned for early 1991.

200. UNESCO activities under the Programme on Prospective Development Studies seek to strengthen national capacities for prospective policy analysis and strategic planning in the organization's field of competence, including science and technology, and to develop a network of institutions and specialists for technical consultations in the area of prospective studies, global modelling and forecasting related to human resources development, including in science and technology. In addition, the Transverse Programme on Statistics covers the compilation, analysis and dissemination of science and technology statistics, including special surveys, and data on personnel and resources for research and development and scientific and technological information and documentation. It is a source of data that could be particularly useful for in-house prospective studies.

United Nations University (UNU)

201. The United Nations University (UNU) has continued to carry out research and training activities in the area of science and technology through an extensive network of scholars representing different disciplines, cultural values and perspectives. In addition to regular UNU programme activities in this respect, recent institutional developments of the university such as the establishment of a new Research and Training Centre - the Institute for New Technologies (INTECH) in Maastricht, the Netherlands - as well as the negotiations for new and specialized research and training centres in Tokyo (an Institute for Advanced Studies with a specific focus on science, technology) and society) and Macau (the International Institute for Software Technology are likely to reinforce the role of UNU in this area.

(i) Science and technology for development

202. This programme consists of two major elements, the production of an authoritative source-book entitled Science, Technology and Development, written by leading researchers, and regional training activities. The source-book is intended to be a scholarly exposition and assessment of the problems perceived in science, technology and development by presenting and illustrating a critical analysis of social, economic and political dimensions in relation to development issues. Elements of this source-book relate to technology assessment and forecasting in developing countries.

203. Training activities are undertaken - in cooperation with UNESCO - in Asia, Latin America and Africa by utilizing elements of the source-book as training material and involving some of its authors as lecturers. The training activities

are specifically tailored to the needs of professionals in developing countries who are involved in science and technology planning activities.

204. Furthermore, a prospective study entitled "High technology in Latin America 2000" is being carried out to assist in a strategic plan for multinational action to enhance that region's technological capacity.

(ii) Implications of advances in science and technology

205. Under this programme, a new seminar series on "frontiers of science and technology" has been introduced by the University to improve the understanding of broader implications of new technologies and new scientific theories and approaches. The first seminar to be carried out under this series, entitled "The Impact of Chaos on Science and Society", will focus on the emerging theory of chaos and its diffusion from the natural sciences to a variety of disciplines such as engineering, economics and social sciences.

206. A second topic under consideration for this series is the issue of "ethics in access to scientific information", a problem which is of increasing importance to third world scientists.

207. The result of these activities may be used as input to the study of methodological aspects of technology assessment and its underlying principles.

(iii) Human dimensions of global change

208. Since its inception in 1988, the "Human Dimensions of Global Change Programme", a joint undertaking with UNESCO, the International Federation of Institutes for Advanced Study and the International Social Science Council has been addressing the human response to global environmental change by means of six working groups encompassing the following issues:

(a) Response strategies for greenhouse gas reduction;

(b) Global risk assessment and critical environmental zones;

(c) Industrial restructuring and industrial metabolism;

(d) Law and global environmental change;

(e) International governance and global environmental change;

(f) Modelling and data needs for human dimensions of global change.

209. Many of the activities focus on the role of scientific and technological elements with regard to the above issues and are of relevance to the assessment of technological options for environmentally sound development.

(iv) Energy, technology and environment

210. Technology can play a role in reducing adverse environmental effects such as global climate change through energy and materials conservation, emission and waste treatment, substitution among energy sources, fuels and materials and recycling of wastes. This programme is designed to contribute to a growing body of knowledge on the environmental implications of energy use and appropriate technological responses, as well as to provide government planners with relevant information in this respect. This activity includes elements of technology assessment/ forecasting.

(v) Register of research of the United Nations system

211. The establishment of a register of ongoing research activities within the United Nations system is being carried out by UNU jointly with the Centre for Science and Technology for Development and in cooperation with the various United Nations agencies and institutes engaged in scientific research. The register would include research undertaken in the area of technology assessment.

(vi) Biotechnology in Latin America and the Caribbean (BIOLAC)

212. This regional programme promotes research, advanced training and dissemination of knowledge in biotechnology and its application for the socio-economic well-being of people and countries in the Latin American and Caribbean region. For this purpose it supports fundamental research in certain specified areas of biotechnology and genetic engineering and serves as the focal point for training and the dissemination of knowledge. This programme may include relevant references to technology assessment.

(vii) Institute for New Technologies (INTECH)

213. This new research and training centre which was inaugurated in June 1990, will focus on the linking of technology policies to sectoral development policies. The programme is multidisciplinary, incorporating over the long run economists, technologists, political scientists and sociologists in assessing the implications of new technologies on developing countries. An initial emphasis in this respect will be made on biotechnology and micro-electronics. Training will also be a major element of the future work of INTECH and include technology assessment as a prime function.

(viii) Other activities and institutional developments

214. UNU is carrying out specific activities on the issue of "microprocessors and informatics", particularly in light of the establishment of the new Macau Institute. Furthermore, negotiations are under way to establish in Tokyo a research and training centre called the Institute for Advanced Studies. One issue under consideration for this Institute is "science, technology and society", with a particular emphasis on technology assessment and forecasting.

World Health Organization (WHO)

215. WHO activities in technology monitoring, assessment and forecasting are framed within its health research policy. New programme trends and developments include the identification and assessment of health problems to which scientific and technological solutions might be sought, and monitoring science and technology for potential relevance to the health sector.

216. This involves conducting long-term research on strategic issues likely to be of increasing importance to member countries. It includes: the development of objective means for prioritizing needs (with due respect to equity) for estimating cost-benefit balance between different problems and between different solutions, and for allocation of resources within the whole national socio-economic context; developing methodology for adapting science and technology to meet national needs, and advising on the dimension of the technology transfer task; and assessing educational needs at both population and professional levels.

217. Five major areas for future developments of health care technology can be predicted by WHO. First, better education in health prevention and contraception for health care professionals, as well as the public, represents an essential prerequisite for the improvement of the health status of populations. Unless the education of health care professionals is radically changed in favour of prevention rather than cure, more paramedical personnel will have to be trained to perform that task, probably using computerized teaching methods. Competent managers for health care systems must be trained.

218. Secondly, inexpensive monitoring technology will be increasingly required for health maintenance and disease prevention, particularly for high-risk groups (infants, children, and the aged). For the intermediate age groups, better and more comprehensive monitoring will be required for cardiovascular diseases, stroke and cancer.

219. Thirdly, better technology for the prevention and treatment of infectious diseases, particularly for children, is required. The current AIDS pandemic has clearly demonstrated the deficiencies that exist in this area.

220. Fourthly, the development of improved technology for chronic disease and for the handicapped, including sensory and motor aids such as prostheses, the means for providing greater mobility, stimulators, and artificial limbs, bones, eyes and ears.

221. Fifthly, protection and improvement of the environment will continue to be essential for any improvement in the health status of individuals and populations.

United Nations Environment Programme (UNEP)

222. UNEP programmes and activities are inherently related to the environmental consequences of technology. The programme for 1990-1991 includes environmental management and supporting measures.

223. Environmental management deals with the preparation of methodologies and actions to prevent and address environmental problems in matters related to the following areas: oceans - focusing on a globally integrated set of action plans for regional seas; desertification; industry, transportation and energy; the effects of technology on the environment; human settlements; and terrestrial ecosystems, which include soils, tropical forests, wildlife, genetic resources, the lithosphere, fresh water resources, management of agricultural chemicals and residues, and biogeochemical cycles.

224. In particular, two main functions directly related to technology assessment are exercised by UNEP in programme implementation:

(a) Policy formulation, planning and institution building: assisting countries in these functions, particularly in coordinating environmental action and economic planning, will enable them to better address the causes and sources of environmental problems;

(b) Fostering environmentally sound technologies: the intent is to promote the development and application of techniques for environmental rehabilitation and enhancement and of environmentally appropriate technologies for meeting human needs through cooperative action-oriented research, dissemination of information, establishment of institutional networks and carefully planned demonstration projects.

225. The following activities foreseen for the period 1990-1991 provide a basis for the above functions:

1. Work on environmental aspects of development planning and cooperation will involve technical publications on: (a) training materials on environmental management; and (b) integration of environmental consideration, development assistance, trade and transnational investments.

Operational activities:

(a) Advisory services to Member States, on request, on the application of methods, policies and procedures for environmental management;

(b) Coordination of the inter-agency pilot project on the integration of environmental considerations in development planning;

(c) Training courses on the use of analytical methods, policy instruments and procedures for environmental management.

2. Work on industry, environment and transportation covers technical publications on: (a) technical guidelines on environmental effects of several industry sectors, particularly: (i) pigments; (ii) electronics; (iii) breweries and distilleries; (iv) glass; and (v) tourism facilities and services; and (b) the quarterly publication of Industry and Environment.

Operational activities:

(a) Advisory services to Member States, on request, on the development of industrial environmental policies;

(b) A network providing information on low and non-waste technologies;

(c) A network of information on industrial accidents;

(d) Training courses on industrial environmental management.

3. In the area of genetic resources, technical publications on (a) environmental effects of emerging biotechnologies; and (b) guidelines for release of genetically modified novel organisms.

Operational activities:

(a) Continuing support to regional microbiological resource centres;

(b) Training courses on biosafety and application of microbial technologies for environmental management.

4. Management of agricultural chemicals and residues; technical publications: (a) level and effect of agro-chemicals, pesticides and fertilizers on the environment; (b) safety of biological control agents; (c) cost-benefit analysis of integrated pest control; and (d) training manuals on biological control, mycotoxin control, zoonosis management, sustainable agriculture and livestock development.

Operational activities:

(a) Training courses on integrated pest control.

226. In 1990, the results of a study commissioned by UNEP on environmental assessment procedures for both capital and technical assistance projects in the United Nations system were made available. 20/ The study looked at procedures for minimizing the potential negative environmental effects of operational activities and found that only the World Bank had formal environmental assessment procedures, with screening categories, designated responsible officials and required reporting. UNIDO was in the process of circulating its draft guidelines for UNIDO officers, and FAO draft procedures are being examined.

227. UNDP has produced Environmental Management Guidelines 21/ which recommend the use of environmental overviews in project documents and of environmental check points in programme and project cycles. WHO, ILO, UNCHS, IAEA and IMO have not yet decided which is the best way to proceed. These recent developments point towards the development of system-wide internal capacities for technology assessment within which environmental impact assessment plays an important role.

International Civil Aviation Organization (ICAO)

228. ICAO constantly keeps abreast of developments in air navigation, including studies and trials being made in individual States. Under a major project, the Special Committee on Future Air Navigation Systems, looking over a time-frame of 25 years, has made recommendations for communications and air navigation systems based on a long-term projection of requirements. The Committee presented a detailed description of the global concept of a satellite-based communications/navigation/surveillance (CNS) system capable of supporting global air traffic management. That system will be submitted to a global air navigation conference, scheduled for 1991, for the purpose of securing its acceptance. In a second phase of this activity, a new special committee has the task of monitoring and coordinating development and transition planning for future air navigation systems.

229. ICAO is also monitoring technological developments in the following areas, with a view to acting as global coordinator, as appropriate, on behalf of the aviation community:

(a) Transition from the instrument landing system to the microwave landing system;

(b) Airborne collision avoidance systems;

(c) Wind shear detection and escape systems;

(d) Advanced explosive-detection passenger screening systems;

(e) World Area Forecast System;

(f) Aeronautical information system automatic programme.

230. These developments, together with the CNS system which will comprise such elements as aeronautical mobile-satellite service, automatic dependence surveillance, the global navigation satellite system and the aeronautical telecommunications system, and other imminent technological developments, will have immediate and continuing influence on aircraft separation standards, airport and airspace capacity congestion and aviation security.

231. Furthermore, ICAO continues to follow developments related to the protection of the environment. An Extraordinary Session of the Assembly of ICAO met in October 1990 to consider operating restrictions on aircraft which exceed prescribed noise levels. ICAO will also monitor the question of aircraft engine emissions at high altitudes and around airports.

International Maritime Organization (IMO)

232. The mandate and activities of IMO require that it deals with issues relating to the safety and environmental effects of maritime technologies. The main current trends have been to integrate into the International Convention for the Safety of Life at Sea new measures necessary to deal with problems concerning the transport

of gas and chemicals by ships. IMO measures to regulate the transboundary movement of hazardous wastes by sea are also currently under review. The tragic accidents of the Herald of Free Enterprise and the Scandinavian Star have focused attention on passenger ship stability and fire protection. Both of those topics are under active examination at IMO. The safety of fishing vessels is the subject of renewed consideration with a view to the development of a protocol to the 1977 Torremolinos International Convention for the Safety of Fishing Vessels.

233. IMO has responded to the need to develop "ozone friendly" alternatives to halons for fire-fighting purposes on board ships as well as alternatives to chlorofluorocarbons (CFCs) for other shipboard uses. Tentative phase-out dates for halons and CFCs are under consideration.

234. Another important new matter is the preparation of studies on the development of a coordinated computerized data bank containing reliable information such as statistics relating to tanker casualties, data on types of ships, and the requirements of IMO instruments for specific ships. This will assist in analysing accidents and determining the measures, including those regarding ship design, to be taken to minimize their recurrence.

235. At the inter-agency level, as reported by UNIDO in its 1980 annual report to the Industrial Development Board, an agreement between IMO and UNIDO has led to joint programmes for the development of shipbuilding and marine engineering, as well as safety rules for transport, cargo and fishing vessels. Moreover ILO, IMO and UNIDO cooperate on the training of personnel for transport and shipbuilding.

236. The principal environmental mandate of IMO is to prevent and control marine pollution caused by shipping activities such as: pollution arising from the normal operation of ships and tankers (for example in disposing of oil residues, tank washings, garbage); and pollution resulting from major spillages and cargo losses caused by maritime casualties. Operational pollution is controlled through the MARPOL 73/78 Convention, of which there are now some 60 parties. MARPOL lays down construction, equipment and operating standards for ships which, if complied with, would prevent the occurrence of pollution. Some 85 per cent of merchant tonnage is certified as complying with MARPOL annex I (dealing with oil pollution) and annex II (liquid chemicals in bulk), while more than 60 per cent of merchant tonnage is covered by annex V which deals with garbage from ships. Annexes III and IV dealing respectively with packaged chemicals and sewage are not yet in force.

237. The IMO approach to accidental pollution is to develop and adopt the highest practicable international standards with respect to safety of navigation, crew training and ship construction and equipment; many of the organization's technical activities are dedicated to this end. IMO has drawn up Manuals on oil and chemical pollution covering such aspects as contingency planning, salvage, and practical techniques for responding to spillages.

238. Modern techniques for preventing operational pollution from ships and for responding to spillages incorporate many recent scientific and technological advances. For example, oil discharge monitoring and discharge control systems use laser technology, fibre optics and other sophisticated techniques to transmit data

from sensors installed in hazardous areas of a ship. Aircraft equipped with side-looking airborne radar (SLAR), infrared and ultraviolet scanners and low-light-level video cameras can detect illicit discharges of oil at night, thus considerably increasing enforcement aspects of the MARPOL regime and providing a valuable means of monitoring the spreading and movement of oil following a major spill. New methods are being developed for the treatment and disposal of chemical residues from ships, and those quantities themselves are being reduced by improved tank coatings and efficient stripping systems.

239. The IMO Global Programme for the Protection of the Marine Environment, now financed at approximately $1.5 million a year, currently provides the main source of funding for IMO technical assistance activities in the environment area, together with individual projects supported by UNDP and UNEP. The diplomatic Conference on International Cooperation on Oil Pollution Preparedness and Response, held in London from 19 to 30 November 1990, provided the international legal framework for cooperation in dealing with major oil spillages, including such matters as research and development, transfer of technology, exchange of information and training, through the adoption of a new international convention on this subject.

International Telecommunication Union (ITU)

240. In the development of standards and their world-wide harmonization, the Permanent Organs of ITU - the International Radio Consultative Committee (CCIR) and the International Telegraph and Telephone Consultative Committee (CCITT) - carry out studies (through various study groups and working parties) and set out recommendations for world-wide application, in which a certain degree of research, forecasting and monitoring is undertaken. The work of the Organs is geared towards technical parameters and functional specifications for systems and networks in order to ensure the highest degree of national and international connectivity and operability.

241. Examples of new technologies and services in which the ITU Permanent Organs are currently involved include:

(a) Fibre-optic networks;

(b) Integrated Services Digital Network (ISDN);

(c) Intelligent networks;

(d) High-definition television (HDTV);

(e) Direct Satellite Broadcasting (DBS);

(f) Universal Personal Telecommunications (UPT).

242. Technology assessment has shown that most of the above techniques and services will be commonplace in the twenty-first century. Standardization will enhance economies of scale for manufacturers and bring about lower prices for customers, thus further accelerating the growth of these services.

243. The fast-changing nature and complexity of telecommunications technology and its progressive convergence with computer technology tends to limit endogenous capacity-building in developing countries. Most progress has been in the production of basic telecommunication equipment which does not involve complex electronics. However, there are a number of developing countries in Asia and Latin America (Brazil, China, India, the Republic of Korea) which are rapidly acquiring and developing, often endogenously, modern telecommunication equipment and systems.

244. The very wide range of telecommunication services and applications make it imperative for ITU to cooperate with many organizations, including:

(a) UPU on electronic mail;

(b) The International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC) on standardization;

(c) UNESCO on broadcasting and other mass media applications;

(d) WMO/IMO/ICAO on certain meteorological, maritime and aeronautical applications;

(e) Intelsat, Intersputnik, Inmarsat, United Nations (Outer Space Affairs Division) on space communications.

Outer Space Affairs Division of the Department of Political and Security Council Affairs

245. The coordination of outer space related activities within the United Nations system is carried out by the Administrative Committee on Coordination's Ad Hoc Inter-Agency Meetings on Outer Space Activities, for which the Outer Space Affairs Division serves as the secretariat. Extensive space technology related programmes of the United Nations bodies and specialized agencies, particularly UNEP, FAO, UNESCO, ITU, WMO, IMO and UNIDO are reviewed at these meetings annually. The report from the 1990 meeting at FAO headquarters in Rome was issued as document ACC/1900/PG/9. Details of current and planned projects can be found in annual integrated reports of the Secretary-General on coordination of outer space activities within the United Nations system. The latest report (A/AC.105/465) to the Committee on the Peaceful Uses of Outer Space contains an overview of the agencies' work programmes for 1991 and 1992.

246. At the request of the Committee, the Outer Space Affairs Division is making regular reviews of resources and technological capabilities of States in different areas of space activities. A report on the economic aspects of strengthening and expanding national and regional data banks and establishing an international space information service as a coordinating centre was issued as document A/AC.105/474, and a comprehensive review of the spin-off benefits of space technology is in preparation.

247. Two reports reviewing, assessing and forecasting main trends in the area of space science and technology are prepared annually in cooperation with the

Committee on Space Research (COSPAR) and the International Astronautical Federation (IAF). The latest reports are "Highlights in space technology and applications 1990" (A/AC.105/476) and "Progress of space research 1989-1990" (A/AC.105/479). A report on possible environmental effects of space activities (A/AC.105/420) has also been prepared for the Committee by these organizations.

248. Each year, during the sessions of the Scientific and Technical Sub-Committee of the Committee on the Peaceful Uses of Outer Space prominent scientists inform delegates from member States about the progress of the International Geosphere-Biosphere Programme and other important developments in space science and technology. A substantive summary of those presentations is issued regularly (A/AC.105/431 and A/AC.105/459). Similarly, the most important papers presented during the various educational and training activities organized by the Outer Space Affairs Division are published under the title "Seminars of the United Nations Programme of Space Applications" (A/AC.105/443 and A/AC.105/468).

249. At its 1990 session, COPUOS proposed that several specific studies should be carried out to demonstrate the potential of space technology, as part of the United Nations efforts in conjunction with International Space Year 1992. In response, the following studies are being prepared by the Division:

(a) Space applications for integrated land and water resources management for rural development;

(b) Remote and rural area satellite communications and broadcasting;

(c) Remote sensing for forest resources management;

(d) Applications of space technology to flood monitoring and control;

(e) Applications of space technology for monitoring desertification;

(f) Applications of space technology for ocean resources development;

(g) Upper atmosphere studies for weather and environment monitoring.

Universal Postal Union (UPU)

250. Aware of the effect of science and technology on the organization of work in postal enterprises, UPU makes a point of helping those enterprises to utilize new technologies by making use of and helping to develop endogenous capacity at the national, subregional or regional levels. To this end, all the permanent bodies of UPU are mobilizing their resources to help the postal enterprises of the Union member countries in general and those of the developing countries in particular to achieve their objectives in connection with the use of science and technology for the modernization of services.

251. At the national level, cngoing UNDP-funded projects include:

(a) The introduction of electronic mail services;

(b) The establishment of a pilot mail-processing centre. This centre, which forms one of the components of a project, is equipped with tools manufactured entirely in the recipient country;

(c) The modernization of post office counters.

252. Under the UPU programme for 1990 and 1991, it is planned to grant consultancy missions and training fellowships to a number of countries, in the following areas: electronic mail, mechanization of mail processing, and computerization of operational services.

253. At the subregional and regional levels, a number of measures have been taken or are planned in order to help groups of countries to implement projects, such as the establishment of workshops for manufacturing postal equipment for the African countries (four projects). These projects, initiated by UPU in conjunction with UNIDO, should receive financial assistance from UNDP under the fifth programming cycle (1992-1996). One of the components of an ongoing project for the benefit of certain European countries covers the study of methodologies for the conducting of computerization projects.

254. In view of the importance of new technologies for the modernization and development of the postal sector, UPU is called on to review such technologies and their potential. These considerations are reflected in UPU policies, programmes and projects for the 1990s.

255. The twentieth Universal Postal Congress (Washington, 1989) set various objectives concerning the use of science and technology in the postal sector. The objectives of the strategic programme entitled "Washington General Action Plan" include:

(a) The introduction, development and promotion of electronic mail services;

(b) The optimum use of automation;

(c) The development of telematics applications.

256. The five-year work programme of the Consultative Council for Postal Studies also includes the following studies relating to science and technology:

(a) Electronic mail;

(b) Automation and computerization.

International Atomic Energy Agency (IAEA)

257. On 23 October 1990, the General Assembly adopted resolution 45/7 on the report of IAEA, in which it recognized the importance of the work of the Agency in promoting further the application of atomic energy for peaceful purposes, as envisaged in its statute, and the special needs of the developing countries for technical assistance by the Agency in order to benefit effectively from the

application of nuclear technology for peaceful purposes as well as from the contribution of nuclear energy to their economic development. The Assembly urged all States to strive for effective and harmonious international cooperation in carrying out the work of the Agency, pursuant to its statute; in promoting the use of nuclear energy and the application of the necessary measures to strengthen further the safety of nuclear installations and minimize risks to life, health and the environment; in strengthening technical assistance and cooperation for developing countries; and in ensuring the effectiveness and efficiency of the Agency's safeguards system.

258. The Director-General of IAEA, in introducing the Agency's 1989 annual report to the General Assembly, referred to the Agency's role in nuclear safety, nuclear waste, transfer of technology and assistance to developing countries.

259. In keeping with its mandate, IAEA activities involve the monitoring, assessment and forecasting of nuclear technology and the physical and chemical sciences and their applications. A comprehensive analysis was made by IAEA of the dominant trends in the global nuclear fuel cycle and on the Agency's projects, with emphasis on expected changes and corresponding probable directions for international cooperation in the 1990s. 22/

260. As part of the programme to improve the long-term availability and diversity of the supply of raw materials or nuclear fuel to meet world demand, a careful analysis was performed on the status and future of the uranium industry.

261. A new version of what is commonly known as the "Red Book", 23/ a joint report of IAEA and OECD and its Nuclear Energy Agency (NEA), appeared at the end of 1990. The main statistical data on uranium resources, exploration, production and demand in the world outside the centrally planned economics area are included in this report, which provides member States with a reliable basis for strengthening their national capabilities for long-term projections and planning of nuclear power development. Within the framework of this activity, two meetings were convened: a consultative meeting on methods for estimation and economic evaluation of undiscovered uranium endowment and resources, and a technical committee meeting on assessment of uranium resources and supply.

262. IAEA is also called on to undertake cooperative work in technological risk management. Properly viewed, the level of risk that nuclear power poses to human health and the environment compares favourably with that of alternative energy sources. To help provide this perspective, the Agency recently initiated a programme on Comparative Assessments of Nuclear Power with Alternatives. The goal is a reliable and authoritative database on the health and environmental effects of the total cycle of energy systems. Work began on compiling this information and on defining a strategy for promoting the integration of such information into energy planning. Agreement was reached with a number of international and regional organizations to jointly sponsor a Senior Expert Symposium on Electricity and the Environment, to be held in 1991. The symposium, a joint effort with the Division of Nuclear Power, will seek a better understanding of the environmental and health effects of different methods of electricity generation and of how this knowledge can be translated into practical policies and practices.

263. The Agency is working with UNEP, UNIDO and WHO to assess the health and environmental risks from energy and other complex industrial systems; the Agency serves as the secretariat for this inter-agency project. This represents a pioneering international effort to develop an integrated approach to the management of risks associated with both routine operations and accidents in large industrial areas. Towards this end, 12 collaborative case-studies are at various stages of implementation in the European and Latin American regions. To support this work, the Agency is also developing a risk management procedure guide which is expected to be published in 1991.

264. In the area of environmental assessment and protection, two publications issued in the IAEA Safety Series provide assistance in applying principles for limiting the environmental release of radioactive effluents. One provides a conceptual framework for establishing upper limits to individual doses from global and regional sources, and the other gives guidance on the setting of limits for the release of radioactive substances during normal operations in the mining and milling of radioactive ores, and on assessing the resulting individual and collective doses.

265. Two Agency-sponsored cooperative research programmes are addressing the problems of the uncertainty and reliability of model predictions. Both programmes stem from recommendations by the International Nuclear Safety Advisory Group following the Chernobyl accident and the adoption of the international Convention on Early Notification of a Nuclear Accident. The research conducted under the ATMES (Atmospheric Transport Model Evaluation Study) programme aims to validate long-range transport models for atmospheric pollutants. Participants are using the recently completed quality assured database for their comparisons of model predictions and the measured data. Co-sponsors are WMO and the CEC.

266. The second programme, known as VAMP (Validation of Models for the Transfer of Radionuclides in Terrestrial, Urban and Aquatic Environments), represents a collaborative endeavour by the IAEA Divisions of Nuclear Safety and Nuclear Fuel Cycle and Waste Management, and CEC. At meetings in December 1989, members of the four working groups reported success in defining model parameters and formulating scenarios for model validation exercises in 1990.

267. Progress has been made in overcoming the various difficulties involved in developing a database for radioactivity measurements in environmental materials, such as the need to accommodate many types of environmental samples, the wide variety of formats used to transmit data and the lack of a system of quality assurance of the data. For example, the geographical coordinates for the sample locations in 17 countries have been loaded into the database. Currently, about 60,000 records of data for about 150 different types of environmental samples compiled can be accessed from the IAEA mainframe computer. Work also began on re-evaluating the existing mainframe database system and on exploring methods of facilitating the use of the system through the transfer of the database to commonly available PC software.

268. In the promotion of research in basic sciences, the International Centre for Theoretical Physics, Trieste, jointly sponsored by IAEA and UNESCO, celebrated its

twenty-fifth anniversary on 31 October 1989 with a ceremony at which the Prime Minister of Italy was the guest of honour, followed by a symposium entitled "Frontiers in physics, high technology and mathematics", attended by 138 participants.

269. The main areas of research and training at the Centre in 1989 were: fundamental physics (high energy and particle physics, cosmology and astrophysics); condensed matter and related atomic and molecular physics including materials science); mathematics (applicable mathematics, analysis, differential geometry, ergodic theory, theoretical fluid mechanics); physics and energy (nuclear physics, plasma physics, non-conventional energy); physics and the environment (soil physics, environmental radioactivity, physics of the atmosphere); physics of space (microgravity); applied physics and high technology (microprocessors, communications, lasers, computational physics, telematics, remote sensing, instrumentation); and science, high technology and development.

270. Some 4,100 scientists took part in the activities of the Centre and in the training programme at Italian laboratories, staying for a total of almost 4,800 man-months; 62 per cent were from developing countries, accounting for 84 per cent of the total man-months. Associate members from developing countries numbered 190, and 652 were researchers from federated institutes in developing countries.

World Bank

271. In the area of environmental management, lending of the International Bank for Reconstruction and Development (IBRD) for free-standing environmental projects has continued to grow. The projects include a national environmental operation in Brazil aimed at protecting the most important conservation areas and endangered ecosystems, and an environment management project in Poland to provide the framework for developing policy, regulatory, institutional and investment actions to improve the environment.

272. In addition, IBRD has completed screening all projects with respect to the type of environmental assessments required, a feature which is now part of operational work. IBRD has also completed the first phase of the Environmental Programme for the Mediterranean in conjunction with the European Investment Bank, and has embarked on the second phase - preparation of specific country programmes. IBRD has also initiated consultations with other international agencies for the purpose of establishing a facility which would provide funding to help developing countries address global environmental issues. The expectation is that work in this area will be completed in 1991.

C. International regime for the transfer of technology

273. Efforts to establish a global framework of norms and standards for the transfer of technology to include the questions of protection of industrial property and the role of transnational corporations have been a goal of the international community for many years. The Vienna Programme of Action reflected this goal in referring to the three international instruments under negotiation within the United Nations system:

(a) Draft international code of conduct on the transfer of technology;

(b) Draft code of conduct on transnational corporations;

(c) Revision of the Paris Convention on the Protection of Industrial Property.

274. While the code of conduct on transnational corporations is expected to be adopted by the General Assembly in 1991, negotiations regarding the other two instruments have continued to stall, reflecting major disagreements among the parties.

275. On 21 December 1990, the General Assembly adopted resolution 45/204 on the draft international code of conduct on the transfer of technology, which calls for the continuation of consultations on the code in order to identify satisfactory approaches to the conclusion of negotiations on that question.

276. As stated by the Secretary-General of UNCTAD to the Second Committee of the General Assembly on 19 November 1990, a global framework of norms and standards for the transfer of technology is still a relevant and important goal for the international community, though there may be a need to rethink the conceptual basis for such norms. This is also the view of most delegations, and gives grounds for hope of reaching agreement on such a framework, whatever its ultimate name. There still does not exist, however, the level of general understanding among regional groups and delegations that would justify an immediate reconvening of the Conference so as to conclude the negotiations. Even so, there certainly is sufficient justification for further discussions to be held within the context of an intergovernmental working group, with a view to determining the extent to which the international endeavours, initiated 15 years ago, can be updated and brought to fruition. The objective of these endeavours is, as before, to establish more predictability and stability in the relationships between suppliers and recipients of technology, thus contributing to a better cooperation in this area of great and growing importance to international economic relations.

277. Continuing a long period of negotiations lasting more than a decade, the General Assembly, in decision 45/443 of 21 December 1990, confirmed that there was substantial provisional understanding on the contents of the draft code of conduct on transnational corporations and decided to arrange for intensive consultations aimed at achieving an early agreement.

278. The draft code contains specific provisions on the role of transnational corporations in the transfer of technology and in the strengthening of the scientific and technological capacities of developing countries. Those provisions are contained in article 36:

"(a) Transnational corporations shall conform to the transfer of technology laws and regulations of the countries in which they operate. They shall cooperate with the competent authorities of those countries in assessing the impact of international transfers of technology in their economies and consult with them regarding the various technological options which might help those

countries, particularly developing countries, to attain their economic and social development.

"(b) Transnational corporations, in their transfer of technology transactions should, in accordance with the criteria set forth in the Set of Multilaterally Agreed Equitable Principles and Rules for the Control of Restrictive Business Practices, avoid restrictive practices which adversely affect the international flow of technology, or otherwise hinder the economic and technological development of countries, particularly developing countries.

"(c) Transnational corporations should contribute to the strengthening of the scientific and technological capacities of developing countries, in accordance with the established science and technology policies and priorities of those countries. Transnational corporations should undertake substantial research and development activities in developing countries and should make full use of local resources and personnel in this process."

279. The first steps for the revision of the Paris Convention were taken in 1974, and a Diplomatic Conference was convened for its first session in 1980. A total of four sessions were held, the last in 1984. The objectives for that revision were set out as follows in the Declaration of the Objectives of the Revision of the Paris Convention, adopted by a Group of Experts in 1976:

"(i) to give full recognition to the needs for economic and social development of countries and to ensure a proper balance between these needs and the rights granted by patents;

"(ii) to promote the actual working of inventions in each country;

"(iii) to facilitate the development of technology by developing countries and to improve the conditions for the transfer of technology under fair and reasonable terms;

"(iv) to encourage inventive activity in developing countries;

"(v) to increase the potential in developing countries in judging the real value of inventions for which protection is requested, in screening and controlling licensing contracts and in improving information for local industry;

"(vi) to ensure that all forms of industrial property be designed to facilitate economic development and to ensure cooperation between countries having different systems of industrial property protection."

280. In 1984, the Assembly of the Paris Union established Consultative Meetings of a limited number of representatives of the negotiating parties to prepare, on substance, the next session of the Diplomatic Conference.

281. Since 1985, six Consultative Meetings have been held, dealing mainly with the proposals for the revision of Articles 1 (Establishment of the Union; Scope of

Industrial Property) and 5A (Patents: Importation of Articles) of the Paris Convention and, briefly, for a proposed new article dealing with the question of conflict between an appellation of origin and a trademark. No agreement, however, was reached during those meetings in respect of the articles discussed.

282. Following the Sixth Consultative Meeting held in September 1989, the Assembly of the Paris Union decided that the preparations for the conclusion of the Diplomatic Conference on the Revision of the Paris Convention will be pursued (a) with the aim that the Diplomatic Conference of revision should take place during the biennium 1990-1991, and (b) that it would meet in extraordinary session in November 1990 to fix further procedural steps and take cognizance of the new proposals of the Director-General of WIPO. At the extraordinary session, it was decided to postpone consideration of those proposals to September 1991, partly because of delays in related negotiations being carried out within the framework of the Uruguay Round of Multilateral Trade Negotiations under the General Agreement on Tariffs and Trade (GATT).

283. Regardless of the difficulties encountered in the present revision process, the Paris Convention, as periodically amended, has proved - by the ever-increasing number of applicants and owners of industrial property rights that claim the benefit of its provisions all over the world, and by the continual growth of its membership - to be an effective international legal instrument for the protection and dissemination of technical achievements and distinctive signs through the industrial property system.

V. COORDINATION AND COOPERATION AT THE COUNTRY LEVEL

284. Important progress on this issue was made with the adoption by the General Assembly on 22 December 1989 of resolution 44/211 on a comprehensive financial policy review of operational activities for development of the United Nations system.

285. In effect, as stated in the report of the Director-General for Development and International Economic Cooperation on this question submitted to the General Assembly at its forty-fifth session, General Assembly resolution 44/211 may be seen as a landmark in many respects. It departs from a protracted pattern of iterating the desirable, and calls for prompt implementation of adjustments and improvements under a three-year schedule, and on a system-wide basis. It concentrates on the country level, and country-specificity in all respects, emphasizing that the system itself should be organized and composed there in such a way that it corresponds to cooperation programmes rather than to its institutional structure. There is a call for decentralization to the country-level, and for the harmonization of programme cycles and simplification of procedures. The concept of decentralization is perceived as closely related to the full use and strengthening of national development capacities, and the resolution envisages Governments being fully enabled to assume responsibility for the execution of programmes and projects funded by the system.

286. The need for integrated programming under the leadership of Governments, and for a programme, rather than a project-by-project, approach, is stated as desirable in the resolution, including ways in which such long-sought objectives may now be met. The kinds of capacities that the United Nations system should make available at the country level, their leadership and their interrelationships, are addressed, and additional work on this comprehensive package of improvements is identified for the next two years (A/45/213, annex, paras. 2-3).

287. At the inter-secretariat level, the Administrative Committee on Coordination (ACC), in its decision 1989/7 of 21 April 1989 on science and technology for development, adopted a statement which, taking fully into account existing approaches developed by each of the organizations concerned, placed emphasis in future activities of the system on:

"(a) Promotion of endogenous capacity-building through the involvement of all segments of society concerned with the development process, including the scientific community and engineers, entrepreneurs, industrialists, producers, consumers and the wider public, all of which are partners in development, to help Member States, in particular the least developed countries, to identify prioritized activities in science and technology;

"(b) Assistance to Member States, at their request, in the development of their technology assessment capacity to enable them to evolve policy issues and options, including those related to the transfer of technology and new and emerging areas of science and technology for development;

"(c) Enhancement of the collective contribution of the United Nations system to endogenous capacity-building of developing countries through technical cooperation activities, including joint inter-agency missions. Such an approach to coordinated efforts at the country level would result in a more harmonized delivery of assistance with a view towards endogenous capacity-building in science and technology" (ACC/1989/DEC/1-20, pp. 6-7).

288. The substantive inter-secretariat coordinating organ, the ACC Task Force on Science and Technology for Development, held its eleventh and twelfth sessions from 7 to 9 May 1990 and 6 to 8 February 1991, respectively. Inter-agency missions for science and technology capacity-building and country-level harmonization and coordination continued to be prominently discussed. The chairmanship of the Task Force from 1981 to 1991 - which is provided using the principle of rotation - is given in table 3.

289. In addition, at the request of the Director-General of UNESCO, the Director-General for Development and International Economic Cooperation convened and chaired an ad hoc high-level inter-agency meeting which was held at UNESCO headquarters on 26 March 1990 to discuss issues of coordination and cooperation in science and technology. The consensus of this meeting included the need to strengthen the role of the Task Force in improving country-level coordination and closer involvement of organizations and agencies through inter-agency missions. 24/

Table 3. Chairmanship of the ACC Task Force on Science and Technology for Development, 1981-1991

Year	Session	Chairman	Agency	Function
1981	1st/2nd	S. K. Jain	ILO	Deputy Director-General
1981	3rd	A. F. Ferrari	CSTD	Executive Director
1983	4th	A-R. Kaddoura	UNESCO	Assistant Director-General for Sciences
1984	5th	D. F. R. Bommer	FAO	Assistant Director-General for Agriculture
1985	6th	G. N. Golubev	UNEP	Deputy Executive Director
1986	7th	F. Partow	WHO	Assistant Director-General
1986	8th	S. C. Trindade	CSTD	Executive Director
1988	9th	S. C. Trindade	CSTD	Executive Director
1989	10th	A. Araoz	UNIDO	Deputy Director-General
1990	11th	A. Araoz	UNIDO	Deputy Director-General
1991	12th	P. Hansen	CTC	Executive Director

290. The importance of effective coordination at the country level was stressed and it was noted that within the United Nations system there had recently been considerable progress in this area. Organizations of the system needed to intensify their efforts to develop a genuine team approach at the country level in support of national plans and priorities (E/1990/123, paras. 47 and 52).

291. The present report has dealt with system-wide activities in science and technology (substantively, under endogenous capacity-building and technology monitoring, assessment and forecasting). System-wide country-level operational activities in science and technology are substantial.

292. The activities of the Centre for Science and Technology for Development in the area of country-level coordination, including inter-agency programme planning and other missions, are contained in documents A/CN.11/1991/9 and A/CN.11/1991/3, which deal, respectively, with the activities of the Centre and the financing of science and technology for development.

293. Issues relating to the implementation of General Assembly resolution 42/211 are discussed in document A/45/273, with regard to general operational activities of the organizations of the system.

294. As indicated in A/45/273, in the area of field representation, UNIDO concluded an understanding with UNDP on the integration of UNIDO Country Directors in UNDP offices. This understanding was essentially confirmed by the UNIDO Programme

Budget Committee in 1990. ITU and UPU have outposted new area representatives (7) and regional advisers (6).

295. While progress in the multidisciplinary advice from the system will be analysed by the Director-General in his 1991 report, the Centre for Science and Technology for Development, UNDP, UNCTAD, UNCHS, WIPO, the Department of Technical Cooperation for Development, UPU, ECA and ESCAP have already taken measures to participate in this approach. The Centre organized a number of inter-agency missions in 1989 as reported to the Intergovernmental Committee under the activities of the Centre.

VI. CONCLUSIONS AND RECOMMENDATIONS

A. Endogenous capacity-building

296. The programmes and activities of the United Nations system showed the continuation of an earlier trend towards greater emphasis on the strengthening of the overall endogenous capacity of developing countries in science and technology, together with the development of specific capabilities in specific technologies within the field of competence of each organization. This trend was especially apparent in resolutions adopted by the United Nations General Assembly and other legislative organs of the system, particularly of FAO, ILO, UNESCO, UNIDO and WHO. Specialized agencies now envisage more explicitly the need to build capabilities for research and innovation in such areas as agriculture, health, education, and industry on the basis of unifying capacities in basic sciences, engineering, data processing and macro-policy sciences.

297. The United Nations system has developed considerable thematic commonality in the field of new and emerging technologies. Work in the areas of biotechnology, micro-electronics and new materials now appears prominently in the programmes and activities of most members of the United Nations system. These activities cover the national, regional, interregional and global levels. For example, the UNIDO-sponsored International Centre for Genetic Engineering and Biotechnology, with headquarters in Trieste and New Delhi, is expected to see the entry into force of its statutes soon thus bringing into legal existence a new multilateral institution of immediate practical importance to developing countries. New regional networks and institutions in the areas of new materials, micro-electronics and biotechnology are rapidly appearing under the sponsorship of FAO, UNESCO, UNIDO, the regional commissions and other organizations of the system.

298. In addition to the thematic commonality in this area, some organizations of the United Nations system have tended to emphasize in their work specific dimensions and aspects. This is the case, for example, of work carried out by UNCTAD on the trade and development opportunities and implications of new and emerging technologies, including micro-electronics, biotechnology and materials technologies. The technology dimension in international trade, including the relationship between technology and international trade competitiveness, has received systematic attention in the work of UNCTAD on technology.

299. Thus, the issue of system-wide coordination in new and emerging areas is expected to become increasingly specialized and complex, giving rise simultaneously to considerations of the transfer of new technology and the evaluation of higher order consequences of technology, which will naturally be seen from different points of view within the system. Ad hoc coordination arrangements have already been made between FAO, ILO, UNEP, UNIDO and WHO regarding the effects of biotechnologies.

300. Progress made in 1990 towards the establishment under the sponsorship of UNIDO of the International Centre for Science and High Technology in Trieste, Italy, calls attention to Trieste as an important seat of the United Nations system activities in science and technology as well as of international research, having in mind the previous existence of the International Centre for Theoretical Physics (UNESCO and IAEA), the International Centre for Genetic Engineering and Biotechnology (UNIDO), the Third World Academy of Sciences (UNESCO and IAEA) and the Research Area of Trieste (Government of Italy). There is a need for continued coordination by UNIDO, UNESCO and IAEA to enable exchange of experience and mutual participation in activities.

301. While the collection and dissemination of national basic science, engineering and technology statistics is the central responsibility of UNESCO, there are several areas of importance for economic analysis where data is not yet adequately provided by the system (including technology indicators, trade in technology, reverse transfer of technology, in which UNCTAD has made important efforts) and economic profitability of research and development activity at the national level. Joint efforts to fill existing gaps in regularly available statistical data should be made by the organizations concerned.

B. Technology monitoring, assessment and forecasting

302. This area, while relatively new, is fast growing in the United Nations system together with the need, both in Member States and at the secretariat level, to develop state-of-the-art capabilities for strategic planning.

303. Collaboration of the United Nations system with regional and international non-governmental organizations in this area, some of which have been established only recently, needs to be developed, especially as those organizations are becoming increasingly representative of the community of professional practitioners. The Centre for Science and Technology for Development, as the focal point for cooperation in technology assessment in relation to non-governmental organizations, should contemplate specific action in that respect during the period 1992-1993.

304. The United Nations system should reinforce its in-house technology management and strategic planning capabilities. In particular, the Centre for Science and Technology for Development, the Department of International Economic and Social Affairs and the Centre on Transnational Corporations should cooperate in 1992-1993 in the work related to the incorporation of technological change in models of the world economy.

305. Consideration should be given to convening in 1992 an international meeting on the role of technology monitoring, assessment and forecasting in strategic industrial planning and management at the national and enterprise levels, with the participation of experts from all the regions, the United Nations system and relevant intergovernmental and non-governmental organizations. That meeting could be organized by the United Nations (including the Centre for Science and Technology for Development and the Department of International Economic and Social Affairs), in cooperation with UNIDO and UNESCO. The results of such a meeting could be reviewed by the Intergovernmental Committee on Science and Technology at its twelfth session in 1993.

306. A series of joint meetings of the Task Force on Science and Technology for Development and the Task Force on Long-term Development Objectives should be held starting in 1992 to discuss system-wide topics relating to medium and long-term technological management and planning, including early warning on technological developments having potential global significance.

C. Coordination and cooperation at the country level

307. The question of country-level coordination in science and technology is being dealt with by the Task Force on Science and Technology for Development. However, the Director-General for Development and International Economic Cooperation and UNDP might be increasingly called on to propose more specific coordination arrangements and in this respect seek to bring the work of the Task Force closer to that of the Consultative Committee on Substantive Questions (Operational Activities) in response to the overall approach to operational activities reflected in General Assembly resolution 44/211.

308. One important substantive issue in this connection concerns the timely provision of coordinated technical support at the country level for activities aimed at strengthening endogenous science and technology capabilities.

309. The closely related question of financing science and technology for development at the national level should be pursued along the lines of the idea of a broad coalition of resources presented in document A/CN.11/1991/3.

310. The promotion of entrepreneurship in developing countries, which is being actively pursued through the operational activities of the system, should include - in particular in the case of UNIDO and UNEP - the following areas which have been insufficiently dealt with:

(a) Financing for the creation of profitable small and medium-sized research and development enterprises to develop environmentally sound technology;

(b) Assistance to facilitate the establishment of consultancy businesses in developing countries to service the needs of enterprises in technology management, including environmental impact assessment and strategic planning.

Notes

1/ 1981: A/CN.11/18; 1982: A/CN.11/24; 1983: A/CN.11/35; 1984: A/CN.11/45; 1985: A/CN.11/58; 1986: A/CN.11/68; 1987: A/CN.11/84; 1989: A/CN.11/89.

2/ General Assembly resolution S-18/3 of 1 May 1990.

3/ General Assembly resolution 45/119 of 21 December 1990.

4/ See draft report of the Conference, A/CONF.147/L.6 and addenda 1-16.

5/ New York, Oxford University Press, 1990.

6/ United Nations publication, Sales No. E.87.II.D.7.

7/ Boulder, Colorado, Westview, 1989.

8/ United Nations publication, Sales No. E.88.II.A.4.

9/ United Nations publication, Sales No. E.87.II.A.4.

10/ United Nations publication, Sales No. E.90.II.A.20.

11/ See documents issued in the series SC.TECH./R.221 and addenda.

12/ See report of the Seminar, SC.TECH./SEM.9/2.

13/ See report of the Seminar, SC.TECH./SEM.17/2.

14/ See document series ECE/SC.TECH./40 and addenda.

15/ See report of the Seminar, SC.TECH./SEM.16/2.

16/ Geneva, World Intellectual Property Organization, 1989 (WIPO/668).

17/ Pierre Auger, Current Trends in Scientific Research; survey of the main trends of inquiry in the field of the natural sciences, the dissemination of scientific knowledge and the application of such knowledge for peaceful ends (New York/Paris, United Nations Educational, Scientific and Cultural Organization, 1961).

18/ Adriano Buzzati-Traverso, The Scientific Enterprise, Today and Tomorrow (Paris, United Nations Educational, Scientific and Cultural Organization, 1977).

19/ Proceedings of a symposium held in Tblisi, USSR, 6-11 December 1981 (Paris, United Nations Educational, Scientific and Cultural Organization; New York, Pergamon, 1984).

Notes (continued)

20/ Environmental Assessment Procedures in the UN system; study prepared at the request of the United Nations system, funded by UNEP (London, Environmental Resources Limited, April 1990).

21/ Francisco Szekely and the UNDP Environmental Action Team, UNDP Guidelines for Environmental Management and Sustainable Development (draft report, January 1990).

22/ Nuclear Fuel Cycle in the 1990s and beyond the Century: Some Trends and Foreseeable Problems, Technical Support Series No. 308 (Vienna, International Atomic Energy Agency, 1990).

23/ URATUM: Resources, Production and Demand (Paris, Organisation for Economic Cooperation and Development, 1990).

24/ The summary record is contained in document TFSTD/XI/7 of 9 May 1990.